Study of Radon Daughter Concentrations in Structures in Polk and Hillsborough Counties

Department of Health and
Rehabilitative Services
Central Operations Services
Radiological Health Services
January 1978

STUDY OF RADON DAUGHTER CONCENTRATIONS IN STRUCTURES IN POLK AND HILLSBOROUGH COUNTIES

This document was promulgated at an annual cost of $3610.00, or $7.22 per copy, to publicize the results of the Department of Health and Rehabilitative Services study which is described in the report title.

Department of Health and
Rehabilitative Services
Central Operations Services
Radiological Health Services
January 1978

FINAL REPORT

OF A

STUDY OF RADON DAUGHTER CONCENTRATIONS

IN STRUCTURES IN POLK AND HILLSBOROUGH COUNTIES

EXECUTIVE SUMMARY

In October 1975, the U.S. Environmental Protection Agency presented a report to the Governor indicating that elevated concentrations of radioactivity in air had been demonstrated in structures built on reclaimed phosphate mining land in Polk County. EPA advised that at the highest levels measured the risk of lung cancer would be doubled after ten years' exposure. DHRS began a study to determine the scope of the problem in November 1975. Actual measurements were begun in July 1976 of radiation levels in 1,000 structures located on Reclaimed land, Undisturbed mineralized land, and Undisturbed non-mineralized land.

This report presents the results of this study in some detail. Conclusions of the study are:

A. No individual in the study area was found to receive an external gamma dose equivalent exceeding the Maximum Permissible Dose (MPD) Recommendations of the National Council on Radiation Protection (NCRP).

B. Excess gamma exposure on reclaimed land was found to be, on the average, a significant portion of the average annual dose in the United States from medical and dental exposures.

C. Significant numbers of persons were located whose annual lung dose equivalent exceed MPD recommendations of the NCRP.

Corrective action shound be taken to reduce the lung exposures which exceed the MPD recommendations. About 4,000 structures are estimated to be located on reclaimed land in Polk and Hillsborough Counties. The study estimated that 6 to 10 percent (240 to 400 structures) will require some kind of corrective action to achieve this result.

The study does not provide sufficient data to permit prediction of air concentrations in structures to be built on presently reclaimed land. This remains a major problem area since without such a method, increased numbers of persons may be exposed to excess radiation doses in the future. This is a public health problem relative to increasing population exposure to ionizing radiation due to growing population density in the study area. Preventive techniques may be applied at a fraction of the cost of corrective procedures carried out at some later time.

CONTENTS

I. The Problem

It has been known for many years that large deposits of phosphate rich material exist in Florida. (Os 1964) Approximately one-third the world's output of phosphate comes from Florida. It has also been known for many years that concentrations of natural uranium are typically found associated with deposits of phosphatic material. (Ca 1953).

In October of 1965 the Florida State Board of Health (now Department of Health and Rehabilitative Services) issued a report entitled "Background Radiation in Florida." (Wi 1965) This report examined external radiation, radioactivity in air, radioactivity in water, and radioactivity in food. One conclusion of that report was that "those individuals residing in the region encompassed by the Bone Valley phosphate deposit are being exposed to a higher level of background radiation than individuals in other regions (of Florida)." The report also concluded, "Further measurements of external gamma radiation and airborne radioactivity and quantitative-qualitative analyses made of radionuclides in food and water are needed before any estimate of total radiation may be made."

Further measurements are not known to have been made until 1971 when a study was conducted by the U.S. Atomic Energy Commission (now Department of Energy). One conclusion of that report was, "Considering the levels encountered within the phosphate plant that we surveyed, as well as the anomalous home and outdoor environments that seem fairly widespread, it is possible that there may be hundreds of individuals in this region whose radiation exposure approaches or even exceeds 500 mrem/year. It is also possible that the mean exposure averaged over the whole population may exceed the national average by something like 50 percent." (Lo 1971).

In 1973 a report, "Reconnaissance Study of Radiochemical Pollution from Phosphate Rock Mining and Milling" was released by the Environmental Protection Agency (EPA) National Field Investigations Center, Denver, Colorado. The conclusion of this study was: "As a result of reconnaissance studies conducted from August to November 1973, and summarization and interpretation of previous monitoring data, it can be shown that the mining and milling of phosphate rock for phosphorous and phosphatic fertilizers constitutes an important source of radium being discharged to the environment." A recommendation of this study was that "EPA immediately initiate an investigation to determine the magnitude and effect of radium-226 in seepage of contaminated water from gypsum ponds, etc." and to "ascertain the possible hazard of emissions of radium and its decay products as a result of phosphate manufacturing." (Na 1973)

In September 1975 the United States Environmental Protection Agency, Office of Radiation Programs (EPA) issued a report on their studies of some radiation levels in Florida. One conclusion of that report was that "Structures built on reclaimed land (Phosphate mining) have radon daughter levels significantly greater than structures not built on reclaimed land." and "Continuous exposure to the highest level measured (0.2 Working Level) for ten years may increase the normal risk of lung cancer for an occupant of the structure by a factor of about two." (Ro 1975). As a result of the 1975 report, it was determined that the Department of Health and Rehabilitative Services (DHRS) Radiological Health Services (RHS) would evaluate a large number of structures which had a potential for falling into the category of exposure outlined above. The purpose of this study was to evaluate the extent of the problem of reclaimed mining land used for residential construction, and to screen as many structures as possible which were identified as being located on reclaimed mining land.

II. The Study

The objectives of the study were:

1. Locate and identify all reclaimed land areas in phosphate mining regions.
2. Locate and identify all structures built on reclaimed land.
3. Determine gamma radiation levels in structures.
4. Determine radioactive radon daughter concentrations in structures.
5. Implement remedial action.
6. Develop control techniques.

The following definitions were adopted in cooperation with the Florida Phosphate Council and other parties:

1. <u>Disturbed Land</u> - shall mean the surface area of the land that is being, or has been mined - etc. - incidental to severance of solid minerals.

2. <u>Reclaimed Land</u>- shall mean land on which backfilling, restructuring, reshaping, or revegetation of <u>disturbed</u> land has been done to a form in which lands may be beneficially used.

Four land Categories were established:

1.	Reclaimed	R
2.	Undisturbed, no mineral under	N
3.	Undisturbed, mineral under	M
4.	Unknown	U

Structures were classed as follows:

1. Basement Construction
2. Slab on Grade Construction
3. Crawl Space Construction
4. Mobile Home

Soil was categorized and divided into two components, i.e., surface and subsurface as follows:

Code	
0	Unknown
1	Virgin Land, no Matrix
2	Overburden and Leach Zone material
4	Leach Zone material only
8	Matrix
16	Sand Tailings
32	Clays (Slime)
64	Debris

The study area comprised Polk and Hillsborough Counties.

The general location of the Bone Valley and Hawthorne formations are shown in figure 1. Figure 2 shows external gamma radiation surveys made in Florida in 1964, previously published by the State Board of Health (Wi 1965). Figure 2 has been updated to show additional areas of elevated external gamma radiation background demonstrated in aerial surveys conducted by the Department of Health and Rehabilitative Services in 1975 and 1976.

The methodology adopted for the study was as follows:

A. Make intensive external gamma measurements both inside and outside the 1000 structures selected for the study.

B. Deploy Track Etch Dosimeters (TE) in 1000 structures located in Polk and Hillsborough Counties (or as many as possible) for a period of 12 months to passively measure Working Level concentrations.

C. Deploy Thermoluminescent Dosimeters (TLD) in 200 structures (20 percent of the 1000 structure sample) to measure annual average gamma dose rates at the location of the TE dosimeter.

FIGURE 1
FLORIDA GEOLOGICAL FORMATIONS REFERRED TO IN REPORT

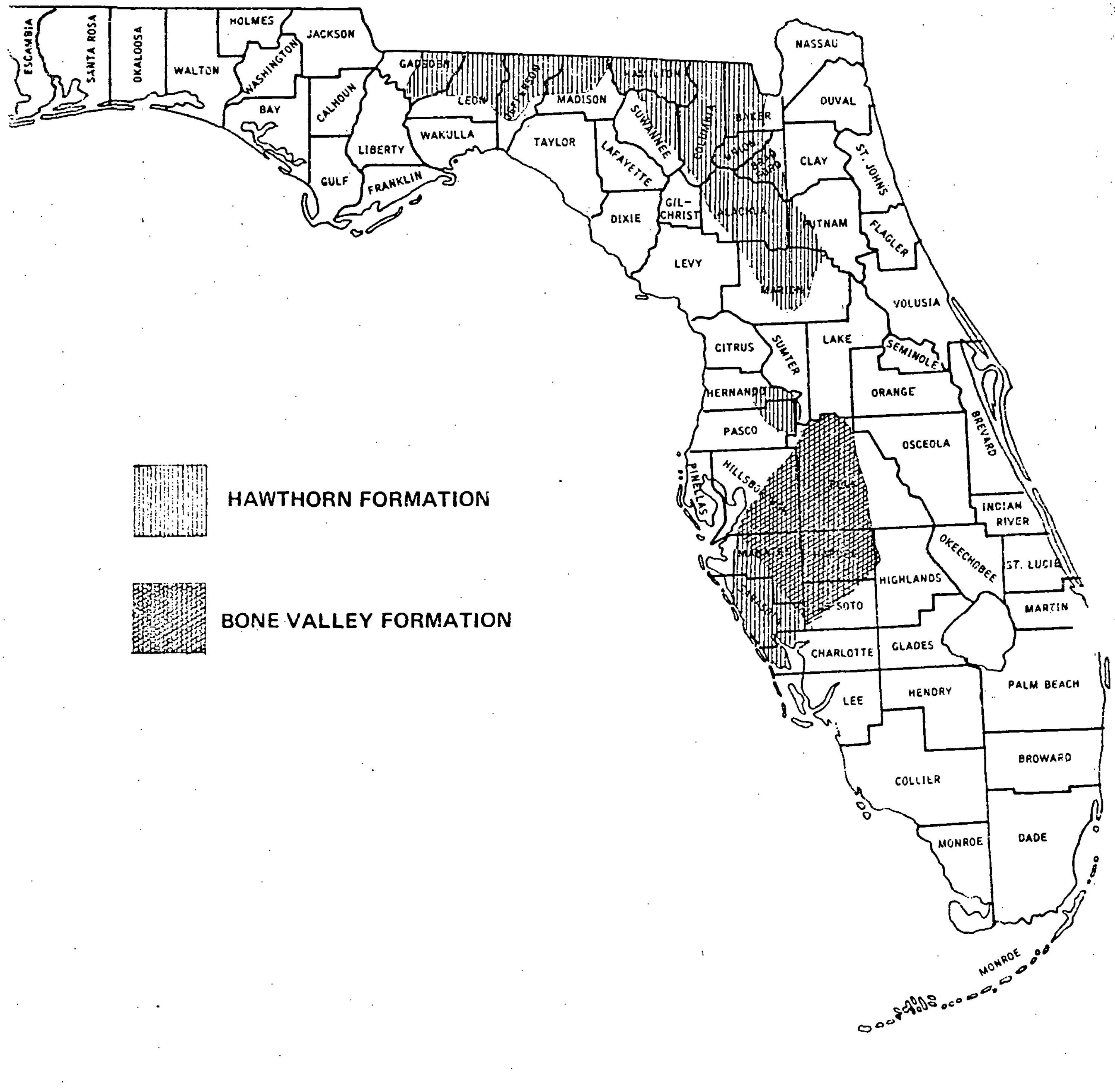
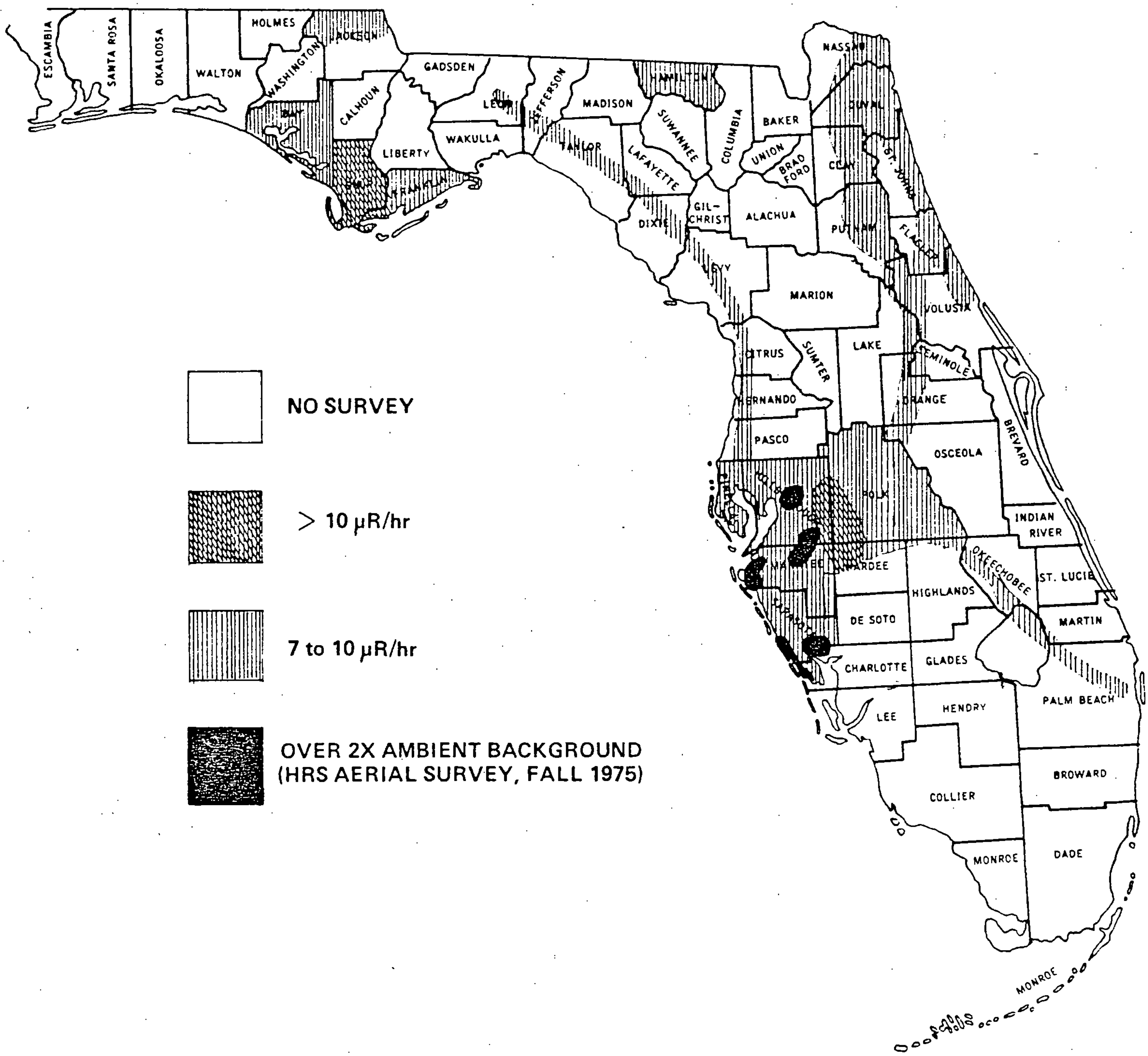


FIGURE 2
EXTERNAL GAMMA RADIATION LEVELS
IN FLORIDA



D. Make measurements in 200 structures (20 percent of the sample) of Working Level concentrations using Integrating Radon Daughter Air Samplers (IRDs) deployed for one-week periods. Four such deployments to be made over one year (seasonally).

Actual numbers deployed relative to the above target values are shown in Table 1.

In establishing the sample of 1000 structures, the following guides were selected:

A. Structures located on reclaimed land - up to 900 structures (R).

B. Structures located on land underlain by phosphate ore but undisturbed - up to 50 structures (M).

C. Residences located on land not underlain with phosphate ore and undisturbed - up to 50 structures (N).

A cooperative program was developed between DHRS, the Polk County Health Department (Polk CHD), and the Hillsborough County Health Department (Hills. CHD) to implement the plan.

A cooperative effort was also made between DHRS and the Florida Phosphate Council in which members of the Council furnished maps of the area to DHRS/CHD with all known disturbed and reclaimed land identified, and with information regarding methods of reclamation used.

Utilizing these maps, personnel of the DHRS/CHD selected areas to meet the distribution requirements of the study. In actual selection of structures, choices were limited by public acceptance of sampling. Classification of structures by land categories is shown in Table 2.

TABLE 1

TRACK ETCH & IRD SITE STATISTICS

TRACK ETCH, GENERAL

Planned Deployment	Actual Deployment	Actual Recovery
1000 site cards	997 site cards	905 site cards
800 site cards to have one TE	799 had one TE	733 had one TE
200 site cards to have two TE and one TLD	195 had two TE and one TLD	169 had two TE and one TLD
	3 had only two TE	3 had only two TE
TE CARDS AT IRD LOCATIONS		
200 sites, preferably to be the same 200 sites that have two TE and one TLD	176 sites	169 sites
	57 sites had two TE and one TLD	55 sites had two TE and one TLD
	119 sites had one TE	114 sites had one TE

NOTE: *Deploy and recover statistics based on site card deployment and recovery records.*

TABLE 2

STRUCTURES SELECTED FOR STUDY OF RADON DAUGHTER CONCENTRATIONS IN POLK AND HILLSBOROUGH COUNTIES BY LAND CLASS

Land Class	Number of Structures	Percent of Total
Unknown (U)	21	2
Undisturbed with Deposits (M)	94	9
Undisturbed, no Deposits (N)	325	33
Reclaimed (R)	557	56
TOTAL	997	

Distribution of structures located on Reclaimed category land for various parameters is shown in Table 3.

TABLE 3

Classification of Study Structures on Reclaimed Land.

Reclaimed Category

Structure Type:

Slab on Grade	331	59 percent
Crawl Space	23	4 percent
Mobile Home	202	36 percent
Basement	1	< 1 percent

Classification by Use.

Single Family Residence	531
Apartments	25
Single Business	1

Classification by Building Material

Masonry	329
Mobile Home	202
Other	26

Classification by Use of Air Conditioning.

Installed (some type)	487
Not Installed	70

Table 4 and figures 3, 4, and 5 show the distribution of the sample by geographical locality.

TABLE 4

Distribution of the Sample Structures by Locality.

Locality:	Number	Percent of Total
Polk County:		
Lakeland	527	53.0
Auburndale	12	1.2
Eaton Park	17	1.7
Ft. Meade	10	1.0
Mulberry	81	8.1
Pierce	2	0.2
Bradley	1	0.1
Bartow	47	4.7
Davenport	25	2.5
Gibsonia	1	0.1
Polk City	25	2.5
Haines City	36	3.6
Frostproof	30	3.0
Dundee	23	2.3
Lake Wales	34	3.4
Winter Haven	67	6.7
Sub Total Polk County	938	94.1
Hillsborough County;		
Tampa	24	2.4
Lutz	1	0.1
Plant City	16	1.6
Brandon	2	0.2
Lithia	8	0.8
Dover	4	0.4
Durant	2	0.2
Valrico	1	0.1
Mulberry	1	0.1
Sub Total Hillsborough County	59	5.9
Total	997	100.0

FIGURE 3
POLK COUNTY
DISTRIBUTION OF IRD
AIR SAMPLING LOCATIONS

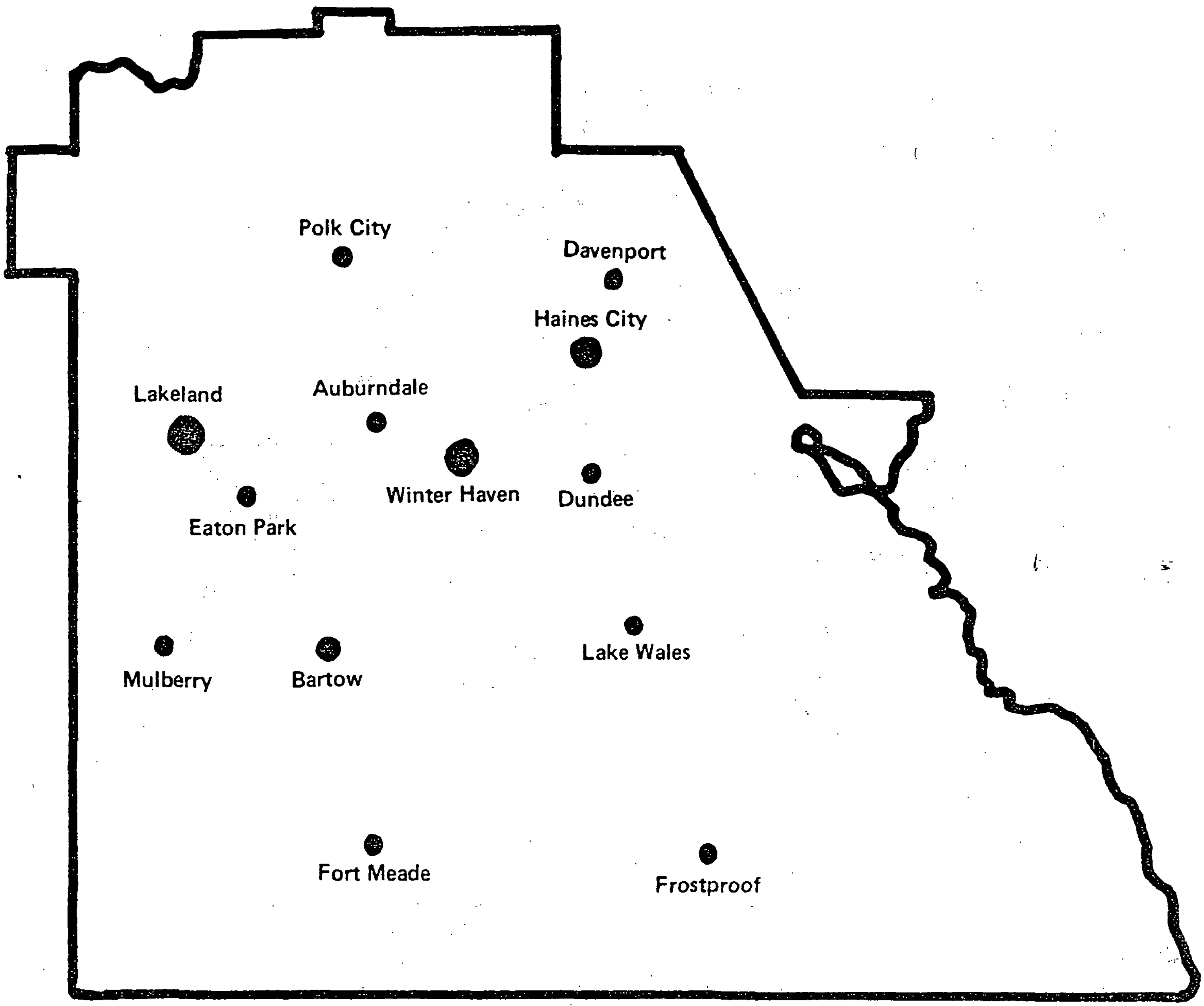


FIGURE 4
DISTRITUTION OF TRACK-ETCH
DOSIMETERS IN POLK COUNTY

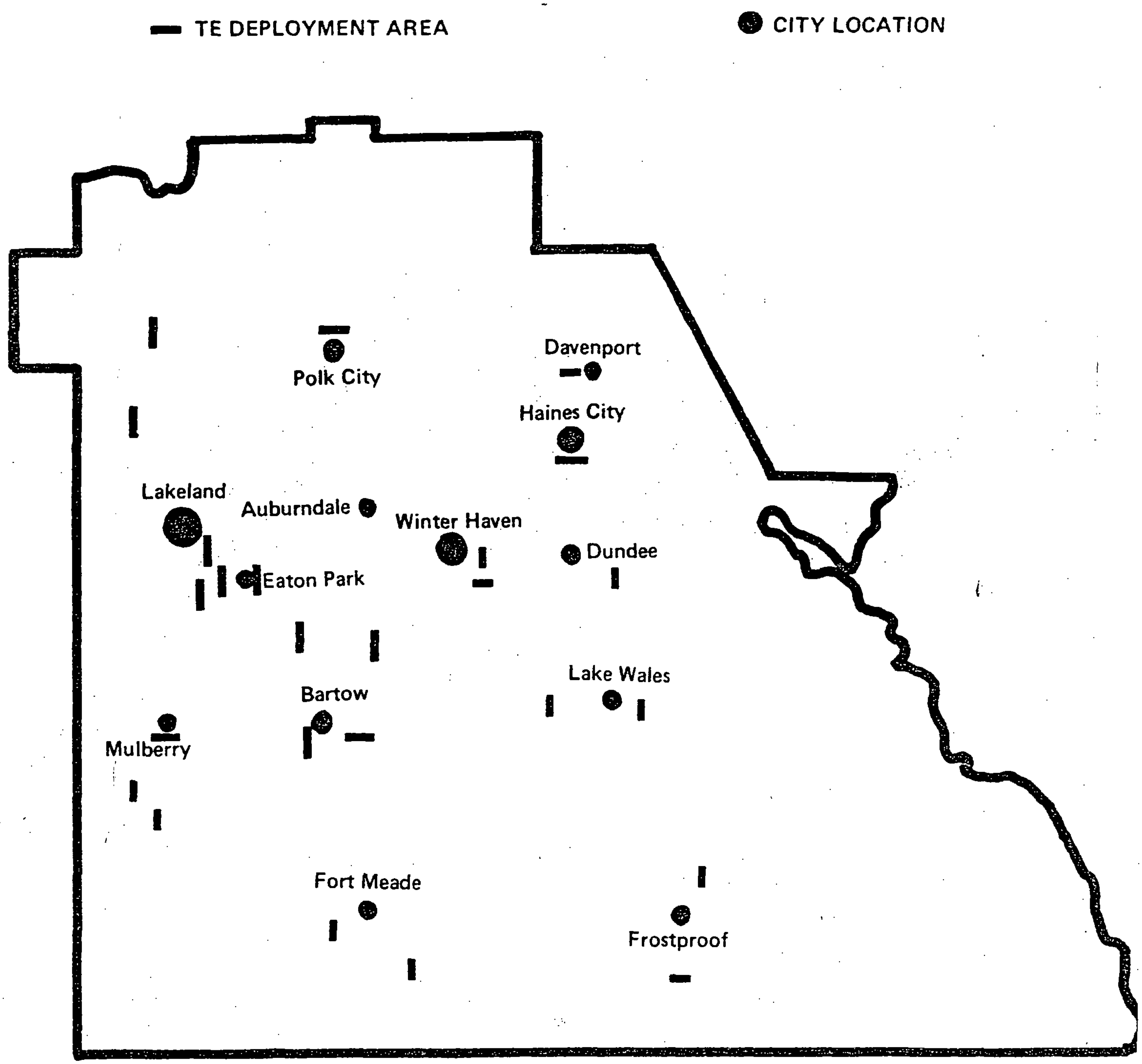
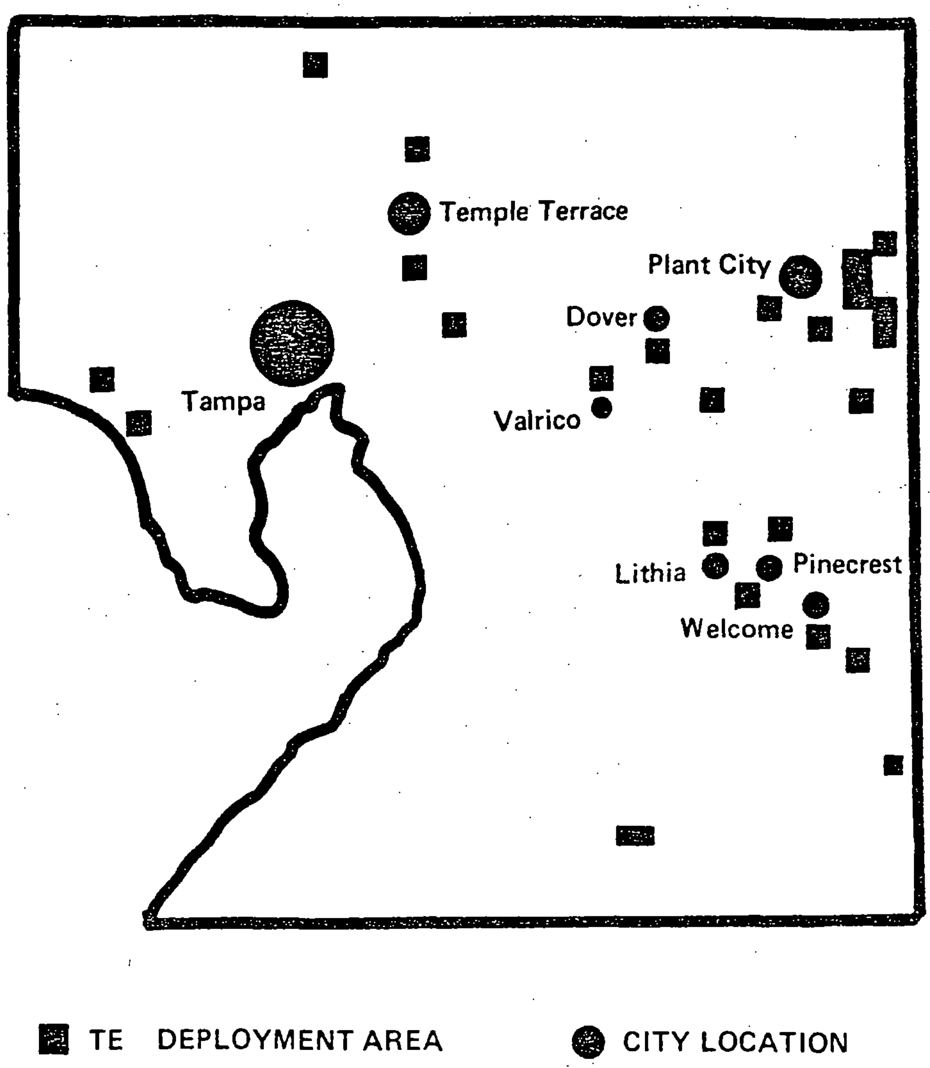


FIGURE 5
DISTRIBUTION OF TRACK-ETCH
DOSIMETERS IN HILLSBOROUGH COUNTY



A group of 176 structures was selected as a subset for analysis using Integrating Radon Daughter Samplers (IRD) for determination of Working Level inside structures.

These were distributed as follows:

TABLE 5

DISTRIBUTION OF AIR SAMPLING
SUBSET BY LAND CATEGORY

Unknown Land Type (U)	4
Undisturbed with Deposits (M)	5
Undisturbed, No Deposits (N)	40
Reclaimed (R)	127

Details of the analyses will be given elsewhere in this report. This number falls short of the target value and includes more structures on "Undisturbed, No Deposits" category land than was planned. This resulted from a lack of sufficient public acceptance of operation of this equipment in their homes in category "Reclaimed" structures.

III. Gamma Radiation Measurements

Gamma radiation levels were measured using Ludlum Model 12S Low Level Scintillation Survey Meters exposed at a height of three feet. These instruments were calibrated over naturally distributed radiation sources against a Reuter Stokes Model RS111 Pressurized Ion Chamber. Measurements were made at locations selected for deployment of the Track Etch Dosimeters and are the same as those shown in figures 3 and 4. Cosmic ray contribution has <u>not</u> been subtracted from the readings reported. Several gamma measurements were made:

A. High outside gamma levels - highest reading observed at location

B. Mean outside gamma levels - the arithmetic average of at least four observations spatially distributed over the structure's building lot.

C. Highest inside gamma measurement.

D. Mean inside gamma levels - as in B. but made inside the structure.

Individual location mean gamma measurements are reported without error limits. Grand mean gamma results are reported with the standard error of the mean calculated as:

$$\frac{\text{standard deviation}}{\sqrt{\text{number of measurements}}}$$

The grand mean of all outside gamma measurements in all study locations is 8.3 ± .24 μrad/hour (see Table 8). This result may be calculated to be different at the .05 confidence level from the mean of gamma measurements made by EPA in 112 locations involved in their previously reported study. This implies that the population studied by DHRS/CHD is significantly different from that studied by EPA, using gamma measurements as a parameter. Results should, therefore, be pooled with caution.

The gamma survey meters used by DHRS/CHD and EPA were intercompared with certain instruments belonging to the U.S. Energy Research and Development Administration (ERDA) and were found to be consistent to an accuracy of about ± 5 percent.

The distribution of gamma measurements is shown in Tables 6 and 7. The data shown in Table 6 are the highest outside gamma measurements at each location.

TABLE 6

DISTRIBUTION OF HIGHEST OUTSIDE GAMMA MEASUREMENT AT SELECTED STRUCTURES

(Includes 988 data points at which this determination was made)

Range of Gamma Dose Rate μrad/hour	Number in Range	Percent of Total
≤10 μrad/hour	707	72
10.1 to 14.9 μrad/hour	181	18
≥15.0 μrad/hour	100	10

The frequency distribution of the mean outside gamma levels for reclaimed and other lands are shown in Table 7.

Results of Mean Outside Gamma Measurements by Land Category are shown in Table 8.

TABLE 7
FREQUENCY DISTRIBUTION OF MEAN-OUTSIDE GAMMA
FOR THE VARIOUS LAND TYPES

Gamma Dose Rate µ rad/hour	'R' Reclaimed	'M' Mineralized but Unmined	'N' Unmined Non-Min.	'U' Unknown
5	17	7	184	2
6	72	20	94	7
7	88	42	24	2
8	94	15	4	1
9	63	4	5	2
10	77	4	5	4
11	38	0	3	1
12	18	0	3	0
13	23	0	0	0
14	12	0	0	2
15	9	0	0	0
16	9	0	0	0
17	5	0	0	0
18	2	0	0	0
19	7	0	0	0
20	4	0	0	0
21	7	0	0	0
22	0	0	0	0
23	3	0	0	0
24	2	0	0	0
25	2	0	0	0
26	1	0	0	0
31	1	0	0	0
34	1	0	0	0

TABLE 8

DISTRIBUTION OF MEAN GAMMA MEASUREMENTS
AT INDIVIDUAL STUDY LOCATIONS

	Outdoor Measurements			Indoor Measurements		
Land Class	Number of Measurements	Mean urad/hr	Standard Deviation urad/hr	Number of Measurements	Mean urad/hr	Standard Deviation urad/hr
R	555	9.97 ± 0.41 (5.0 - 34.)	9.73	556	8.18 ± 0.19 (5.0 - 25.0)	4.48
N	322	5.74 ± 0.07 (5.0 - 12.0)	1.26	322	5.65 ± 0.07 (5.0 - 12.0)	1.19
M	92	7.01 ± 0.12 (5.0 - 10.0)	1.12	92	7.04 ± 0.14 (5.0 - 11.0)	1.30
U	21	8.14 ± 0.59 (5.0 - 14.0)	2.71	21	7.38 ± 0.47 (5.0 - 12.0)	2.16
Total Population	990	8.28 ± 0.24 (5.0 - 34.)	7.60	991	7.24 ± 0.12 (5.0 - 25.0)	3.64

(-) Range of individual location means.

The means of mean Outside Gamma Measurements of the distributions for the Reclaimed category (R) compared with the undisturbed-No Deposits category (N) and the undisturbed but minerlaized category (M) appear to be significantly different at the .05 confidence level. The means of mean outside gamma on Category M land are also significantly different from Category N land.

One conclusion from these data is that if the mean inside gamma exposure varied from the mean outside gamma exposure it was generally less. Most structures located on reclaimed land showed little or no difference between mean inside and outside gamma dose rates (57 percent of the cases the change is -1, 0, or +1 μrad/hr.) In 42 percent of the cases the reduction inside was greater than 1.0 μrad/hr. An increase greater than 1.0 μrad/hr was found in only 0.1 percent of the cases. It may be concluded from this comparison that structural materials in use in the study area do not consitute an important source of gamma radiation exposure at the present time.

In evaluation of the distribution (Table 7) of mean outside gamma results, neither the "Undisturbed-No-Deposits" or "Reclaimed" categories appear to be normally distributed. A log probability plot of these data indicates that the "Reclaimed Category" gamma exposure measurements probably represent separate distributions of data, each of which is approximately lognormal.

The significance of this result is that reclaimed category land probably cannot be considered to be a uniform population. It has been proposed by Roessler, et al, that Reclaimed lands may be categorized as; (Ro 1977)

A. Overburden Reclaimed

B. Sand Tailings Reclaimed

C. Capped and Mixed Clays

D. Debris Land

With a Category "Unaltered" equivalent to Category M and N. A breakdown of study locations on reclaimed land by type of surface soil is shown in Table 9.

TABLE 9

Mean Out-Side Gamma Measurements on Reclaimed Category Land By Surface Soil. (343 locations classified-others unknown)

Soil Type	Number Locations	Means of Mean of Outside Gamma
Overburden (2)*	156	9.7 µrad/hr (6-21 µrad/hr)
Sand Tailings (16)	183	9.7 µrad/hr. (6-25 µrad/hr.)
Clays & Tailings (32)	4	(21.5 µrad/hr.) (Range 10-34 µrad/hr.)
Unknown (0)	211	(----)

* ( ) soil code, see II-2

The classification of surface soil is dependent upon information furnished by individual phosphate companies from company records, and the terms are general in nature. It is quite possible that debris occurs in some locations which have been otherwise categorized. This could account for the great range of mean external gamma results. While the mean gamma of the categories "Overburden" and "Sand Tailings" is the same, there is a great difference in the variability as expressed by the standard deviation (i.e., Overburden 10.2, Sand Tailings 3.5). Based on these data, it must be concluded that the mean outside gamma parameter, alone, will not serve to differentiate between "Reclaimed" category land classes as defined in this study.

Thermoluminescent Dosimeters (TLD) were deployed on the same cardboard sheet which was used for deployment of the track etch dosimeters. These were exposed for the entire one-year period. The dosimeters were composed of one TLD chip in a plastic carrier. Two types of TL material were utilized, i.e., CaF:Mn and CaF:Dy. All chips were enclosed in an energy compensating shield to compensate for the hyperlinearity of CaF at low energy. A subset of these data has been evaluated and results are shown in Table 8. Results are rounded to the nearest μrad. The means of the two devices (TLD's and Ludlum's) cannot be shown to be different at a .05 confidence level for the "Reclaimed" category.

TABLE 10

COMPARISON OF MEAN INSIDE GAMMA
AS MEASURED BY 1 YEAR DEPLOYED TLD
VS LUDLUM MODEL 12S "GRAB" MEASUREMENT

(µrad/hour)

	Reclaimed	Undisturbed Mineralized	Undisturbed Non-Mineralized
TLD Mean	8.52 ± .50	6.41 ± .33	7.40 ± .51
Standard Deviation	4.74	1.37	3.74
Ludlum Mean	7.56 ± .30	6.48 ± .27	5.74 ± .12
Standard Deviation	2.84	1.10	0.89

There is however, a statistically significant difference at the .05 confidence level between the devices for the "Undisturbed, non-mineralized" Category. It must be remembered that this is a comparison of a measurement at one location in structure with the mean of at least four measurements at different locations within the structure.

TABLE 11

Gamma Exposure Measurements in
Florida Schools - Mean Values at
Each Location.

County	Number of Schools	Mean of Mean Observations Outside	Mean of Mean Observations Inside
Polk	88	9 µrad/hr (6-23)	8 µrad/hr (6-16)
Orange	100	7 µrad/hr (6-17)	7 µrad/hr (6-22)

(-) Range of individual location means. At least three measurements averaged at each location.

Measurements were made with survey meters identical to those used in the present study in the Polk County public schools in January 1975, and in the Orange County public schools in April 1975. Results are shown in Table 11. The land category of the schools is not known, but they provide fair geographical coverage of the Counties. It can be seen that the mean of the 88 Polk County schools is slightly less than that of the 555 measurements (see Table 8) made on reclaimed land and greater than that of the 322 measurements made on undisturbed land. We tested the hypothesis that the mean of Orange County schools is equal to that of Polk County schools. The hypothesis of equality cannot be rejected at the 0.05 confidence level. When the data are pooled with each county divided into quarters, it can be shown that a significant difference does exist between schools in the southwest quarter of Polk County and the remainder of the two counties.

To evaluate the public health impact of external gamma radiation exposure, a normal background exposure dose must be estimated. Results reported are measurements with scintillation detectors whose response has been related to ionization chambers. Results, therefore, represent absorbed dose in air (rad). For the radiation being considered, absorbed dose in air can be considered approximately equivalent to the absorbed dose in tissue (rem). The outside mean exposure dose in air for 322 measurements on unmined, unmineralized land has a grand mean value of 6.0 μrad/hour with a range of

5.0 µrad/hour to 12.0 µrad/hour. This is consistent with the dose of 7 µrad/hour measured at 100 public schools in Orange County (range of 6.0 µrad/hour to 17 µrad/hour). These values appear to be typical of unmined land with no ore deposits in Central Florida. At an exposure dose rate of 6.0 µrad/hour, the average annual absorbed dose to the whole body would be about 52.6 mrem/year (with a range of 43.8 mrem/year to 105.1 mrem/year). The National Council on Radiation Protection and Measurements (NCRP Report 39) states "there is no validated deleterious effect from natural background radiation in the portion of the population receiving the higher ranges of natural radiation, but it must be recognized that satisfactory epidemiological studies to determine such effects are probably impractical." Certainly no great interest has previously been shown in control of the upper ranges of the natural radiation background. This appears to be true despite the fact that an increased risk of health effect can be calculated for the upper range when compared with average values using the linear extrapolation of health effects convention. In the Central Florida case an annual excess outside dose of 52 mrem exists between individuals exposed to the upper limit when compared to those exposed to the average. The average indoor external gamma exposure for locations on land classed as "reclaimed" is 8 µrad/hour (rounded value) with a range of 5.0 µrad/hour to 25 µrad/hour. The average indoor value is well within the range of the normal background and would result in an annual absorbed dose of about 70 mrem/year.

NCRP Report 39 states "the dose limit for the critical organ (whole body) of an individual, not occupationally exposed, shall be 0.5 rem above normal background (500 mrem) in any one year." The indoor upper limit of the reclaimed category (25 μrad/hour) would produce an annual dose of 219 mrem. When the average of the normal background (53 mrem/year) is subtracted from this value, the highest annual excess exposure for an individual indoors can be calculated to be 166 mrem/year, (33 percent of the recommended dose limit). No corrective action recommendations are proposed. It is the conclusion of this report that average gamma exposures to most persons living on reclaimed land is within the range of normal background exposures and that no individual would be exposed to doses which exceed maximum recommended exposure to individuals in the general population.

IV. Measurement of Working Level.

Direct measurements of Working Level Concentrations were attempted at 176 locations. These analyses were made using Integrating Radon Daughter Samplers (IRDS) based on a design developed by EPA and Colorado State University (Radon Integrating Progeny Sampling Unit-RIPSU). This device draws air through a particulate filter and measures the radiation produced by the daughters of radon-222 using a thermoluminescent dosimeter (TLD). A second TLD monitors the gamma radiation only and is used to subtract the gamma contribution to the primary TLD. The distribution of this subset is shown in Table 12.

TABLE 12
Distribution of Structures Selected for Working Level Concentration Measurements using Integrating Radon Daughter Air Samplers. (IRD).

<u>Distribution by Land Class</u>

Total structures attempted	176	100 percent
Number of Reclaimed Land	126	72 percent
Number of Other Land Classification	50	28 percent

Distribution by Mean Outside Gamma dose rates

$\leq$10 µR/hour	132	75 percent
10.1 to 14.9 µR/hour	25	14 percent
$\geq$15.0 µR/hour	19	11 percent

Geographical distribution of members of the subset is shown in Table 13 and in Figure 3.

TABLE 13

Geographical Location of Structures
Selected for Working Level Concentration
Measurements using IRD Air Samplers.

Lakeland	91
Eaton Park	5
Ft. Meade	4
Bartow	11
Davenport	3
Haines City	13
Dundee	2
Lake Wales	4
Winter Haven	5
Frostproof	1
Lithia	1
Auburndale	2
Mulberry	29
Polk City	5

It can be seen that the percentage of structures in this subset located on reclaimed land is greater than the percentage of structures so located in the total sample. As previously stated the percentage of structures, in the total sample, located on reclaimed land is less than the desired percentage established in design of the study. The subset therefore more closely approaches the study design than does the total sample. The distribution of the subset by mean outside gamma dose rate is essentially identical to the total sample.

The results of the IRD analyses are reported in Attachment 1. A total of 130 of the selected locations have a valid annual mean Working Level reported. Four valid measurements were attained at only 71 locations due to technical difficulties with the sampling system.

Results of the annual WL are shown in table 14 as a frequency distribution. The data do not appear to represent a single normal distribution but may, as was the case with mean outside gamma measurements, represent two or more log normal distributions. When the data for "Slab on Grade" structures on category "N" land are plotted separately, the data appear to be approximately log normal.

The mean WL for structures on reclaimed category land is 0.013 WL ($\sigma = .012$) compared to the mean for structures on category "N" land of 0.004 WL ($\sigma = .002$). The variances of the distributions cannot be shown to be different at the .05 confidence level.

TABLE 14

Frequency Distribution
of IRD WL Concentrations

mean WL	Reclaimed	Undisturbed Unminerialized
.001	0	1
.002	2	6
.003	4	7
.004	13	8
.005	10	1
.006	6	1
.007	10	2
.008	6	1
.009	7	0
.010	4	0
.011	5	0
.012	3	1
.013	3	0
.014	3	0
.015	1	0
.016	0	0
.017	2	0
.018	1	0
.019	0	0
.020	0	0
.021	0	0
.022	0	0
.026	2	0
.027	1	0
.029	1	0
.030	1	0
.031	1	0
.033	1	0
.034	2	0
.035	1	0
.037	1	0
.038	1	0
.047	1	0
.051	1	0
.069	1	0
	$n = 96$	$n = 28$
	$\overline{X} = .013$	$\overline{X} = .004$
	$\sigma = .012$	$\sigma = .002$

The hypothesis that the two means could have been drawn from a population with a single mean must be rejected at the .05 confidence level. We, therefore, adopt the alternative hypothesis that the mean WL of structures built on reclaimed land is significantly different (greater) than the mean WL of structures built on Category "N" land.

As stated, a plot of the frequency distribution of structures on Category "R" land indicates that more than one distribution may be present. Within the category (R) the mean of the "Slab on Grade" structure is .013 WL (σ = .012) compared to the mean for "Mobile Homes" which is .006 WL (σ = .003). The variances of these distributions may be shown to be different at the .05 confidence level. The mean WL for Mobile Homes on Category R land cannot be shown to be different from structures on Category "N" land at the .05 confidence level. The difference appears to be confined to the "Slab on Grade" structures. The mean of "Slab on Grade" structures on Category R land can be shown to be different from the mean WL of Mobile Homes on Category R land at the .05 confidence level.

The results reported in Attachment 1 represent analysis of TLD devices from the IRDs by the Orlando Radiological Laboratory; EPA Eastern Environmental Facility, Montgomery, Alabama; and EPA Radiological Laboratory, Las Vegas, Nevada. Interlaboratory comparisons were conducted for the analysis in August 1976, at the beginning of the study, and again in July 1977 near the end of the study. The results are listed in Table 15.

TABLE 15

Laboratory Intercomparison for IRD/RIPSU
Measurements at Common Locations

Year	ORP/LV	ORP/EERF	DHRS/Orlando
1976*	.123 ± .048	.118 ± .051	.114 ± .044
1977*	.020 ± .002	.024 ± .002	.024 ± .003

* NOTE: the 1976 & 1977 locations are not the same.

No intercomparison was made at very low WL concentrations. The agreement at the two concentrations intercompared is quite good.

In calculating the annual mean working level reported in attchment 1, the following conventions were adopted:

A. Pump running times of 24 hours or less were rejected and not used to calculate the mean. Valid single measurements are not reported as the mean annual WL.

B. A mean is not reported for only two valid measurements unless the combined running time equals or exceeds 125 hours.

C. The error reported for the mean annual WL is the standard error of the mean, ie:

$$\frac{\text{Standard Deviation}}{\sqrt{\text{number of observations}}}$$

Considerable difficulty is encountered in evaluating reports in the literature of national average background WL concentrations since most of the papers report concentrations of Radon-222 and require unsupported assumptions of the percentage of equilibrium of short lived daughters to estimate WL concentrations. NCRP Report 45 reports a dose equivalent rate of 90 mrem/year to the lung as a whole (450 mrem/year to the segmented bronchioles) due to inhalation of a standard concentration of Po-218 (Po-214) of 0.15 pCi/liter of air. This concentration is about the equivalent of 0.0015 WL. The dose equivalent rate from Radon-222 is considered to be negligible. The same publication states the average dose equivalent from natural background sources of Po-218 (Po-214) to be about 100 mrem/year to the lung as a whole (500 mrem/year to the segmented bronchioles) in the United States, inferring a national average WL concentration of about 0.001 WL. The average background for the Grand Junction Colorado area as measured by the Colorado State Health Department, is reported to be 0.004 WL. No range is stated. (Sc 1973)

In the present study, an average WL concentration for ' Slab on Grade' structures built on category 'N' land is 0.004 WL (σ=.002). The range is 0.001 to 0.012 WL. The upper limit of the natural background annual dose equivalent rate can be calculated to be 720 mrem/year to the lung as a whole (3600 mrem/year to the segmented bronchioles).

Estimated lung dose equivalent rates for individuals residing in Bartow, Orlando, and Jacksonville as reported in the 1965 report of the State Board of Health are shown in Table 16.

TABLE 16

ESTIMATED LUNG DOSE FROM RADON-222 DAUGHTERS FOR INDIVIDUALS RESIDING IN BARTOW, ORLANDO AND JACKSONVILLE FOR 1964 (Wi 1965)

	Annual Equivalent Dose Rate (light work/resting)	Calculated Annual Mean WL to Produce Annual Equivalent Dose Rate
Bartow	266 - 242 mrem/year	.004 WL
Orlando	182 - 166 mrem/year	.003 WL
Jacksonville	130 - 153 mrem/year	.002 WL

The estimated annual dose equivalent rate for Bartow is quite consistent with that calculated for the Grand Junction Colorado area and with that calculated annual mean WL of .004 WL found in the present study. It is the conclusion of this report that the mean annual natural background WL concentrations in the study area is .004 WL.

Twenty-seven percent (see Table 14) of the structures in the subset exceed the upper limit of the background estimated for the area (i.e., .012 WL). Based on this estimate by the subset, 150 of the 557 structures on Category R land, could be expected to exceed the upper limit of the background.

NOTE: Background has not been subtracted from the results shown in Attachment 1 and Table 14.

TABLE 17

Annual Dose Equivalent to the Critical Organ (Lung) using NCRP Model (mrem/year)-Continuous Exposure

Annual Average Working Level	Category	Lung Dose (mrem/year) As a Whole*	Lung Dose (mrem/year) Segmented Bronch*
.004	Average Background	240	1200
.012	Upper-limit Background	720	3600
.057	Highest Measured WL minus upper limit of background.	3420	20700
.029	Possible Control Level (.025 WL above .004 WL Bg)	1740	8828

*Does not include dose equivalent resulting from external radiation.

An estimated dose equivalent for various WL concentrations is shown in table 17. If an upper limit dose equivalent to the whole lung of 1500 mrem/year** above the average natural background is adopted, table 17 indicates a control upper limit concentration of .029 Working Level. (.025 WL in addition to a background of .004 WL). Twelve of the 96 structures on category "R" land in the subset equal or exceed .029 WL (12.5 percent). This limit would ensure that no individual would receive an annual dose equivalent greater than 1500 mrem/year to the whole lung above the average natural background with an assumption of continuous occupancy. **Based on NCRP Occupational MPD to whole lung.

The average annual dose equivalent in excess of the average natural background for persons living on Reclaimed land within the study area can be calculated to be 540 mrem/year to the whole lung. If it can be shown that the occupancy factor is other than 1.0 (continuous), the proposed guideline of 0.029 Working Level may be adjusted proportionally.

Dose to the whole body has thus far been examined separately. It should be realized that the inhalation dose is not confined to the lung, but it is a source of exposure to other organs as well. Using the calculations of Pohl (Po 1977), it can be shown that the average excess exposure to the bone marrow (when compared with the average background) for persons living on Reclaimed land would be 4 mrem/year from the inhalation pathway. The highest total bone marrow dose on Reclaimed land is estimated to be 28 mrem/year.

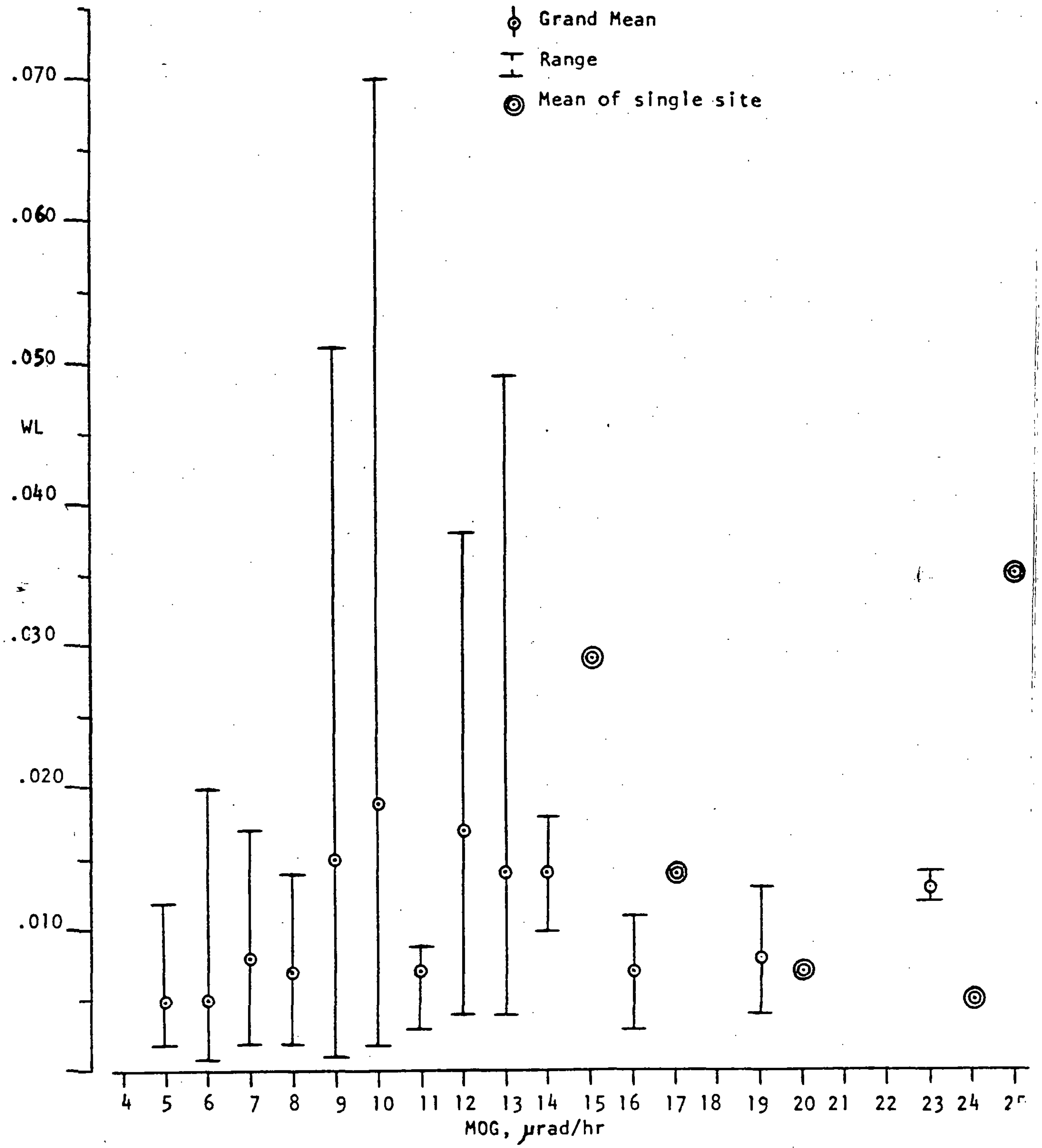
V. Relationship of Mean Outside Gamma Measurements to Average Annual Working Level Concentrations

The relationship between mean outside gamma measurements and average annual working level concentrations in the data subset has been examined. Figure 6 shows a plot of these data. The data were tested for independence using a chi-square test. The hypothesis that the data are independent cannot be rejected at the .05 confidence level. An analysis of variance was also conducted, and the hypothesis that there is no regression of WL on mean outside gamma cannot be rejected at the .05 confidence level.

This result is unfortunate since quick inexpensive gamma measurements would be an attractive method of evaluating unimproved reclaimed land to predict its suitability for construction. Based on present data, this does not appear to be possible. Sufficient data are not available to permit this report to evaluate other parameters such as emanation rates of radon-222 or solid radium-226 concentrations, as predictors of annual average WL concentrations.

FIGURE 6

COMPARISON OF MEAN OUTSIDE GAMMA EXPOSURE RATE (MOG)
TO IRD MEASURED WORKING LEVEL (WL)



VI. Track Etch Results

Track Etch Dosimeters (TE) were recovered from 905 of the 997 locations in which they were deployed. This is a recovery rate of 90 percent. The General Electric Company Track Etch Dosimeter (Service Mark of G.E. Company) are dielectric detectors which are sensitive to alpha particles emitted from radioactive substances.

Chemical etching then enlarges the latent tracks until they can be recognized and counted using appropriate techniques. The data from the track etch measurements are reported in track density (T/mm^2). The calculation of WL involves construction of a regression line of the track density vs. working level hours (WLH) as estimated for the location. The IRD sampler detects alpha particles essentially originating only from daughters of radon-222.

At the time of deployment, it was anticipated, based on work by the General Electric Company, that the uncertainty of estimates of WL by this method is as shown in table 18.

Table 18

Percent Error Expected from Track Etch Dosimeters Deployed for 1 Year (8760 hrs.)

WL Concentration	Percent Error
.001	165 percent
.002	121 percent
.005	80 percent
.01	59 percent
.02	43 percent
.05	29 percent
.10	21 percent

It was anticipated that this imprecision would permit the device to be utilized for screening only. Based on experience gained with the IRDs, it was anticipated that track density (T/mm^2), when plotted as a frequency distribution, would not represent a normal distribution.

Prior to estimating the annual average WL concentrations from the track densities shown in Attachment 2, a suitable, random subset of the track densities were compared as shown in Table 19.

TABLE 19

COMPARISON OF TRACK DENSITIES

Category	$\bar{X}$	σ	Range	Number of Samples in Each Category
M-2-1 Polk	12.9	6.16	2.95 to 33.5	48
M-2-1 Hills.	5.8	8.26	1.74 to 36.89	17
N-2-1 Polk	3.4	1.52	0.69 to 7.99	50
N-2-1 Hills.	2.3	2.78	0.17 to 14.67	26
R-2-2 Polk	11.6	16.36	0.87 to 52.6	50
R-2-16 Polk	7.4	5.04	0.69 to 22.57	50

We tested the hypothesis that the Polk and the Hillsborough County category M samples could have been drawn from populations with equal means (the variances are significantly different). This hypothesis must be rejected at the .05 confidence level and the alternative hypothesis, that they represent different populations, adopted. The null hypothesis cannot be rejected at the .05 confidence level for the category N samples from the two counties, i.e., cannot be shown to be different. There are significant differences in track density distribution between category R-2-2 and R-2-16 populations.

For purposes of the regression analysis, the data were segregated as follows:

1. Mobile home - reclaimed land (R-4)
2. Slab on grade - reclaimed land - soil category 2 (R-2-2)
3. Slab on grade - reclaimed land - soil category 16 (R-2-16)
4. Slab on grade - category N land (N)

A regression analysis was performed on each category.

TABLE 20

REGRESSION ANALYSIS OF WORKING LEVEL HOURS AS A FUNCTION OF TRACK DENSITY. (y = WLH $x = T/mm^2$)

Category #	Regression Equation ($y = mx + b$)	Correlation Coefficient
1. R-4-	$y = 12.58x - 1.94$	$r = 0.95$
2. R-2-2	$y = 10.64x + 6.18$	$r = 0.96$
3. R-2-16	$y = 8.09x + 25.35$	$r = 0.71$
4. N-2-	$y = 4.22x + 17.52$	$r = 0.74$

The standard error of y on x ($S_{y \cdot x}$) was calculated and multiplied by 1.96 to establish an upper limit at the .05 confidence level. The equations for this upper limit line are shown in Table 21.

TABLE 21

0.05 UPPER CONFIDENCE LIMIT FOR DATA SHOWN IN TABLE 13. (Min. Detectable at 1.68 T/mm^2)

Category #	Regression Equation	Min. Det. WL
1. R-4-	$y = 12.58x + 45.84$	0.008
2. R-2-2	$y = 10.64x + 85.32$	0.012
3. R-2-16	$y = 8.09x + 107.59$	0.014
4. N-2-	$y = 4.22x + 42.33$	0.005

The equations in Table 21 were utilized to interpret the track density data (T/mm^2) which are reported in Attachment 2.

Category #			
	N- -	=	Undisturbed non-mineralized land.
	R- -	=	Reclaimed land.
	-2-	=	Slab on grade structure.
	-4-	=	Mobile home.
	- -2	=	Overburden and leach zone surface soil.
	- -16	=	Sand tailings surface soil.

One segment of the study involved deployment of two track etch films on the same cardboard backing at each of 200 locations. The difference between the track densities of these replicates expressed as a percentage have been evaluated. The average difference was found to be 31 percent without regard to sign. The sign of the differences has been found to be random in nature. Since the replicates were exposed to the same radiation field and received identical handling, this replication is considered to be very poor and could represent a serious source of error in the reported results.

It has been determined in the DHRS Laboratory that the error associated with the TLD devices used in the IRD measurements at that laboratory is ± 36 percent. The total error associated with the track etch estimate of WL can be expected to be not less than ± 48 percent. This value is consistent with the G. E. estimates in the range of observation. This error appears to be inherent in the measuring system when used to estimate WL at very low concentrations. Working Level is reported, therefore, in Attachment 2 as "less than the listed value." The large error limits of the reported values make decisions regarding corrective action very uncertain. It is a conclusion of this report that these data should be used only as a screening tool to determine which structures require additional measurements with a more accurate transducer.

Frequency distributions by category of land for these 95 percent upper confidence levels are shown in Table 23. The values may be used to estimate the distribution of the population of structures sampled. The percentage of structures in each category which exceed the upper limit of the natural background (i.e., category N land) is shown in Table 22.

TABLE 22

STRUCTURES WHICH EXCEED CERTAIN WORKING LEVEL CONCENTRATIONS

Land Category	Percent $\geq$.012 WL	Percent $\geq$.029 WL
Reclaimed	69	9.2
Undisturbed, mineralized	100	18.6

The value .012 WL has been previously estimated as the upper range of the undisturbed unmineralized category background (normal background). Inferences should not be drawn from the fact that all of the reported concentrations for category M land exceed .012 WL since this value is the lower limit of detection for this category land. The percentage of structures exceeding the upper limit of the natural background is higher when inferred from TE estimates than when measured with IRDs (i.e., 27 percent). This is to be expected since TE estimates are upper confidence limits. The conclusion which may be drawn is that less than 69 percent of the structures sampled exceed the upper limit of the natural background with the range expected to be from 27 to less than 69 percent.

Individual structures reported in Attachment 2 as exceeding the guideline should be evaluated further before corrective action recommendations are made.

TABLE 23

Frequency Distribution of Track-Etch Predicted Upper Confidence Working Level by land category

Pred. WL	Disturbed Reclaimed	Undisturbed Mineralized	Undisturbed Nonmineralized	Unknown Land Type
.008 / below	121	0	277	0
.009 - .011	47	0	6	0
.012 - .014	80	18	1	5
.015 - .017	101	9	1	2
.018 - .020	52	14	2	3
.021 - .023	27	9	0	2
.024 - .026	23	15	0	1
.027 - .029	13	4	0	0
.030 - .032	12	4	0	3
.033 - .035	10	4	0	0
.036 - .038	1	3	0	1
.039 - .041	2	1	0	0
.042 - .044	7	2	0	0
.045 - .047	1	1	0	2
.048 - .050	3	1	0	0
.051 - .053	2	0	0	0
.054 - .056	3	1	0	0
.057 - .059	3	0	0	0
.059 and above	3	0	0	0
Total Number	509 9.2% $\geq$ .029 WL	86 18.6% $\geq$ .029 WL	287 0.0% $\geq$ .029 WL	19

VII. Evaluation of a Subset of Structures whose Mean Annual Working Level Concentration is 0.025 WL or Greater

This section evaluates a subset of structures whose annual average WL concentration equals or exceeds 0.025 WL. This value was arbitrarily selected. A total of 113 structures is included in the subset. The mean WL concentration as estimated by Track Etch dosimeters is <0.036 ± .001 WL with a range of <0.025 to <0.097 WL. A frequency distribution of the subset by geographical location is shown in table 24.

TABLE 24

DISTRIBUTION OF SUBSET BY CITY

City	*Number of Structures in Subset*	Percent of Subset in this City	Percent of Total Study Population in this City
Lakeland	73	64.60	56.20
Bartow	19	16.80	5.00
Mulberry	16	14.20	8.60
Fort Meade	2	.13	.21
Pierce	1	.88	.10
Lithia	1	.88	.10
Eaton Park	1	.88	.10

The subset is examined by structural details in Table 25. These percentages have been determined on an individual basis and should be propagated with caution.

TABLE 25

PERCENTAGE DISTRIBUTION OF THE SUBSET FOR VARIOUS PARAMETERS

Structure Class	Percentage of Subset	Percentage of Class R and M Structures in Total Study	
Single Family Residence	92.0	90.5	
Apartments	7.0	4.8	
Single Business	.1	.1	
Type:			
Basement	1.8	.1	
Slab on Grade	93.8	59.0	
Crawl Space	2.6	4.0	
Mobile Home	1.8	36.0	
Levels:			
One	96.5	97.7	
Two	2.7	2.2	
Three	.8	.1	
Material:			
Masonry	97.3	93.7	(excluding
Non-masonry	2.7	6.3	mobile homes)

A structure considered to be a "typical Florida home" is a single family residence, slab on grade, one level, masonry construction. These comprise 84.1 percent of this subset. In the total sample 56.2 percent of all the structures on Reclaimed and Mineralized Undisturbed lands are of this type. A test of difference between proportions indicates that the percentages shown above are significantly different.

Gamma dose rates inside and outside were examined for this subset. Results are shown in Table 26. It is of interest to note that the mean gamma measurements of the subset of highest annual WL concentrations is only slightly elevated above the mean gamma results for the total sample. The distribution of the subset by range, township, section and quarter section is shown in Table 27.

TABLE 26

GAMMA EXPOSURE, OUTSIDE AND INSIDE FOR SUBSET

Gamma Rate μr/hr	Mean Outside Gamma Number	Mean Inside Gamma Number
6	1	11
7	15	34
8	18	32
9	20	10
10	19	12
11	6	10
12	6	2
13	3	0
14	7	1
15	2	0
16	2	0
17	2	0
18	1	0
19	3	0
20	2	0
21	2	0
22	0	1
23	1	0
25	1	0

Outside Mean 10.76 ± 0.37 μr/hr
Outside Range 6 to 25 μr/hr

Inside Mean 8.22 ± 0.20 μr/hr
Inside Range 6 to 22 μr/hr

TABLE 27

LOCATION DISTRIBUTION OF SUBSET BY
METES AND BOUNDS (TOWNSHIP, RANGE, SECTION)

Location	Number Subset Structures	Number Track Etch Deployed	Percent ≥.025WL
28S, 24E, SE12	1	3	33
28S, 24E, SE29	17	66	26
28S, 24E, NW29	1	1	100
28S, 24E, SW26	1	15	07
29S, 23E, SW12	3	12	60
29S, 23E, SE12	9	12	75
29S, 23E, SW13	1	1	100
29S, 25E, NE27	4	5	80
30S, 23E, SW01	2	12	17
30S, 23E, SE01	12	27	44
30S, 23E, SE25	1	2	50
30S, 23E, SE26	2	12	17
30S, 22E, NE33	1	1	100
31S, 25E, SW30	1	1	100
28S, 24E, SE32	1	11	09
28S, 24E, SW32	5	22	23
28S, 24E, NW32	4	10	40
28S, 24E, NE32	1	47	02
29S, 24E, SE12	1	5	20
29S, 24E, SW05	22	44	50
29S, 24E, SE05	6	17	35

TABLE 27 (continued)

LOCATION DISTRIBUTION OF SUBSET BY
METES AND BOUNDS (TOWNSHIP, RANGE, SECTION)

Location	Number Subset Structures	Number Track Etch Deployed	Percent $\geq$ .025 WL
29S, 24E, NW08	1	5	20
30S, 25E, NE03	5	6	83
30S, 25E, NE04	1	1	100
30S, 25E, NW17	8	12	67
30S, 25E, SE20	1	1	100
32S, 25E, NW17	1	2	50

It is the conclusion of this report that no single parameter appears to be common to the subset of structures with the highest annual WL concentration.

There appears to be a rather marked relationship between the percentage occurrence of values $\geq$ .025 WL and the geographical location (see Table 27). There is a strong relationship between structure type and WL $\geq$ .025 since 93.8 percent of these concentrations occurred in "Slab on Grade" structures. Only 2.6 percent of crawl space structures and 1.8 percent of mobile homes showed concentrations $\geq$ .025 WL.

VIII. Summary of Estimates of Radiation Exposure in the Study Area

Estimates of radiation doses to people in the Study Area have been given in previous sections of the Report. These are summarized in Table 28 and Table 29.

TABLE 28

SUMMARY OF DOSE TO WHOLE BODY
FROM EXTERNAL AND INTERNAL PATHWAYS

Category	External Gamma (Indoors)	Bone Marrow Dose from Inhalation#	Total Dose
Mean Background	53 mrem/yr	2 mrem/yr	55 mrem/yr
Mean Reclaimed Land	70 mrem/yr	6 mrem/yr	76 mrem/yr
High Reclaimed Land	219 mrem/yr	28 mrem/yr	247 mrem/yr
Average Excess* Reclaimed Land	17 mrem/yr	4 mrem/yr	21 mrem/yr

* Average Reclaimed Land minus Average Background.

\# Assumption - Inhalation of Radon-222 and daughters at 1.0 pCi/liter of air will produce a bone marrow dose of 0.05 μrad/hour. A QF of 10 is assumed for internal dose. Breathing rate is 14.0 liters per minute.

TABLE 29

SUMMARY OF DOSE TO THE LUNG FROM
INHALATION OF RADON-222 DAUGHTERS

Category	Lung Dose mrem/yr*	Annual Average WL
Mean Background	240 mrem/yr	0.004
Mean Reclaimed Land	780 mrem/yr	0.013
High Reclaimed Land	4140 mrem/yr	0.069
Average Excess Reclaimed Land	540 mrem/yr	0.009

* Assumption - Continuous inhalation of 0.0015 WL will produce a dose to the whole lung of 90 mrem/year.

A comparison of this dose with other major sources of radiation exposure is shown below.

	Indoor Whole Body	Lung Dose
Average Background Exposure in Study Area	55 mrem/yr	240 mrem/yr
Average Excess Exposure on Reclaimed Land	21 mrem/yr	540 mrem/yr
Highest Excess Exposure on Reclaimed Land	192 mrem/yr	3900 mrem/yr
Average U.S. Exposure to Medical and Dental X-Ray	72 mrem/yr	---

A summary of various sources of radiation exposure as reported by the National Academy of Sciences (BEIR Report 1972) is shown in Table 30.

TABLE 30

SUMMARY OF ESTIMATES OF ANNUAL WHOLE BODY DOSE RATES IN THE UNITED STATES (1970)

Source	Average Dose Rate* (mrem/yr)	Annual Person-Rems (in millions)
Environmental		
Natural	102	20.91
Global Fallout	4	0.82
Nuclear Power	0.003	0.0007
Subtotal	106	21.73
Medical		
Diagnostic	72**	14.8
Radiopharmaceuticals	1	0.2
Subtotal	73	15.0
Occupational	0.8	0.16
Miscellaneous	2	0.5
TOTAL	182	37.4

* Note: The numbers shown are average values only. For given segments of the population, dose rates considerably greater than these may be experienced.

** Based on the abdominal dose.

It is of interest to note that table 30 does not include an estimate for Technologically Enhanced Natural Radiation. A Task Force of the National Conference of Radiation Control Program Directors has issued a Report on Natural Radioactivity Contamination - 1977. This report states that "the largest radiation dose to individuals is from Technologically Enhanced Natural Radiation." It further reports, "the third largest category of population dose is estimated to be from TENR which contributes about 3 million person-rem/year (to the U.S. population)."

This report confirms the findings of the Task Force stated above and indicates that in the Study Area TENR may have a much greater relative importance than the National Average. Technologically Enhanced Natural Radiation in the Study Area constitutes an important source of radiation exposure both to individuals and a source of population dose. The risk from this TENR is about equal to that from the natural background in the Study Area and also about equal to exposure from Medical and Dental irradiation.

Doses in this report were determined as follows. Exposure doses (rads) were measured values in air, as were exposure doses in Working Levels. Absorbed doses (rem) were calculated based on certain assumptions:

<u>Assumptions Used for External Gamma Absorbed Dose</u>

1. Continuous occupancy.
2. All of the exposure dose is absorbed. This is a conservative assumption which was necessary because the energy spectrum of the external gamma exposure is not known with certainty. True absorbed dose cannot exceed reported values, but it may be less.

Assumptions Used for Absorbed Lung Dose

1. Continuous occupancy.
2. Breathing rate 20 liters/minute.
3. Ten percent of Po-218 concentration is unattached.
4. Quality Factor is 10.
5. Tissue exposed is the total mass of the Standard Man lung (1000 grams).

The absolute upper limit for absorbed dose to the lung for 0.001 Working Level can be calculated to be 210 mrem/year if all of the exposure dose is absorbed. The assumption of the DHRS report is that 0.001 Working Level produces an absorbed dose of 60 mrem/year for the above assumptions. This represents an absorbed fraction of 29 percent of the absolute upper limit.

The National Academy of Sciences reports (BIER Report) the upper limit of absorbed dose for 1.0 Working Level - Month exposure to be 1.0 rad to the basal cell layer of the larger bronchi. They adopted a value of 0.5 rad for risk estimates in their report, using a Quality Factor of 10. If a factor of 1/5 is utilized to average this absorbed dose over the mass of the entire lung, it can be calculated that 0.001 WL gives 50 mrem/year for continuous exposure (with an upper limit of 100 mrem/year). The value adopted in the DHRS report (from the National Council on Radiation Protection - Handbook 45) is greater than the value utilized, but less than the upper limit reported by the NAS. The uncertainty of this dose conversion is no greater than the uncertainty associated with measurement of exposure in Working Levels.

IX. Summary and Conclusions

1. No individual has been found in the present study whose dose equivalent from external gamma exceeds recommendations of the National Council on Radiation Protection and Measurements (NCRP) for an individual in the general population (i.e., 500 mrem/year). External gamma, however, represents a major source of radiation exposure to the population. The annual average dose equivalent resulting from excess radiation exposure on enhanced land (above natural background) has been found to be 17 mrem/year. The potential effect of this exposure on the population is a function of the number of persons exposed as well as the annual average exposure.

2. The largest source of radiation exposure in the Study Area is the dose to the lung resulting from inhalation of the daughters of Radon-222. The annual average excess exposure on enhanced land has been found to be 540 mrem/year to the whole lung. This exposure is more than twice as great as that resulting from the natural background in the Study Area and more than five times as great as the national average dose equivalent reported in NCRP Handbook 45 (i.e., 100 mrem/yr).

3. A significant number of individuals are presently exposed to radiation doses to the lung which exceed Maximum Dose Recommendations of the NCRP.

   A. The study data indicate that radiation levels in structures on undisturbed non-mineralized land do not approach or exceed this guideline.

B. Radiation levels in structures on undisturbed-Mineralized land approach and some exceed this guideline.

C. Radiation levels in structures built on Reclaimed lands approach and some exceed this guideline.

4. Corrective action should be taken to reduce radiation exposure of individuals whose exposure exceeds Maximum Permissible Dose Recommendations of the NCRP for individuals in the general population. Corrective action <u>may</u> be taken to further reduce radiation exposure of individuals to levels substantially lower than the Maximum Permissible Dose, hence lowering their risk.

5. A major problem exists in evaluating land, which is presently unimproved, to predict radiation exposure to occupants of structures which may be built on such land in the future. Such a model is important in preventing increases in the percentage of the total population exposure to enhanced natural radiation. Such a model cannot be developed at this time from the data presented in this report.

GLOSSARY

Curie (Ci)	quantity of radioactive material which will produce 3.7×10^{10} distintegrations per second.
milli (m)	1×10^{-3}
micro (μ)	1×10^{-6}
pico (p)	1×10^{-12}
rad	unit of abosorbed dose, i.e. absorbed dose of 100 ergs per gram.
radon-222	decay product of radium-226. Chemically a noble gas with a half life of 3.8 days.
rem	unit of dose equivalent i.e. dose in rad x Quality Factor (QF).
Working Level -	the potential alpha energy from the short lived daughters of radon which will produce 1.3×10^{5} mev in one liter of air. Equivalent to 100 pCi/liter radon-222 in air in equilibrium with its short lived daughters.

BIBLIOGRAPHY

Ca 1953 Cathcart, J.B. and McGreevy, L.J. Results of Geologic Exploration by Core Drillings; 1953 Land Pebble Phosphate District Florida, pp; 221-298. In U.S. Geological Bulletin 1046K, 1953.

Lo 1971 Losder, W.M. Indoor Radon Daughter and Radiation Measurements in East Tennessee and Central Florida. 1971 Health and Safety Laboratory, U.S. Atomic Energy Commission (HASL T M 71-8) New York, N.Y.

Na 1972 National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," 1972.

Na 1973 Reconaissance Study of Radiochemical Pollution from Phosphate Rock Mining and Milling, National Field Investigation Center, Denver Colorado. U.S. Enviromental Protection Agency 1973.

Os 1964 Osmond, J.K. The Distribution of the Heavy Radio Elements in the Rocks and Waters of Florida, pp; 153-159. In J.A.S. Adams and W.M. Lowder eds. The National Radiation Enviroment. University of Chicago Press 1964.

Po 1977 Pohl E. and Phoh-Rulling Health Physics, June 1977 p. 552 Pergamon Press, New York, N.Y.

Ro 1975 Rowe, W.D. Preliminary Findings Radon Daughter Levels in Structures Constructed on Reclaimed Florida Phosphate Land. (Tech. Note ORP/CSD - 75-4) 1975 U.S. Environmental Protection Agency Washington, D.C.

Ro 1977 Roessler, C.L. Personal Communication

Sc 1973 Schaiger, Keith J. Radon Progeny Control in Buildings, Colorado State University. May 1973.

Wi 1965 Williams, Edwin G. Background Radiation in Florida. Florida State Board of Health, October 1965.

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs.	Mean Outside Gamma
70406	Lakeland	R	4	.008 $\pm$ .002	4	514	6
70409	"	R	4	.004 $\pm$ .001	4	405	7
70416	"	R	4	.004 $\pm$ .002	3	346	7
70446	"	R	4	.005 $\pm$ .001	4	604	7
70476	"	R	4	Invalid	1	168	6
70496	"	R	4	.003 $\pm$ .001	3	319	6
70501	"	R	4	Terminated	1	169	6
70516	"	R	4	Invalid	1	47	5
70531	"	R	4	Terminated	1	168	6
70539	"	R	2	.038 $\pm$ .014	4	697	12
70556	"	R	2	.011 $\pm$ .008	2	168	7
70558	"	R	2	.069 $\pm$ .002	3	149	10
70559	"	R	2	.006 $\pm$ .002	2	325	8
70560	"	R	2	Terminated	1	168	9
70562	"	R	2	.011 $\pm$ .002	4	518	10
70563	"	R	2	.031 $\pm$ .004	4	399	10
70570	"	R	2	.009 $\pm$ .005	3	348	7
70571	"	R	2	.011 $\pm$ .003	3	366	7
70573	"	R	2	.009 $\pm$ .001	4	357	6
70575	"	R	2	.004 $\pm$ .001	4	670	7
70576	"	R	2	Terminated	1	98	7

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTGERATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70577	Lakeland	R	2	Terminated	0	---	7
70579	"	R	2	.006 ± .000	3	178	6
70580	"	R	2	.009 ± .003	3	341	7
70581	"	R	2	Terminated	1	175	7
70584	"	R	2	.017 ± .004	4	818	7
70586	"	R	2	.018 ± .003	4	618	10
70587	"	R	2	.011 ± .004	4	694	7
70604	"	R	2	.007 ± .001	4	721	6
70607	"	R	2	.005 ± .003	2	246	9
70608	"	R	2	Terminated	1	27	10
70609	"	R	2	.009 ± .004	4	599	11
70610	"	R	2	Terminated	1	157	11
70613	"	R	2	.005 ± .001	4	568	9
70615	"	R	2	.003 ± .000	4	519	10
70616	"	R	2	Terminated	1	162	10
70617	"	R	2	Terminated	1	---	10
70628	"	R	2	.009 ± .004	4	351	10
70629	"	R	2	.004 ± .001	3	380	10
70632	"	R	2	.014 ± .005	4	644	8
70636	"	R	2	.005 ± .001	4	389	9
70637	"	R	2	.005 ± .001	4	453	8
70651	"	R	2	.006 ± .001	4	421	10

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Struc-Ture Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70653	Lakeland	R	2	.004 ± .001	4	581	7
70656	"	R	2	Terminated	1	51	10
70657	"	R	2	Invalid	1	143	6
70666	"	R	2	.005 ± .001	3	481	6
70667	"	R	2	Terminated	0	0	8
70674	"	R	2	Terminated	1	167	7
70776	"	R	2	.004 ± .001	3	438	9
70677	"	R	2	.005 ± .001	4	738	8
70680	"	R	2	.004 ± .001	4	468	6
70682	"	R	2	.007 ± .001	4	391	8
70683	"	R	2	.005 ± .001	4	513	9
70687	"	R	2	.008 ± .002	4	408	8
70688	"	R	4	.003 ± .002	3	296	8
70692	"	R	4	Terminated	1	116	8
70693	"	R	4	Terminated	1	150	11
70696	"	R	4	.006 ± .002	3	396	8
70708	"	R	2	.013 ± .001	3	421	8
70709	"	R	2	Terminated	1	109	12
70717	"	R	4	Terminated	1	227	15
70718	"	R	2	.008 ± .002	3	311	8
70732	"	R	4	Invalid	1	37	13

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70735	Eaton Prk.	R	2	.008 ± .002	3	459	9
70738	Eaton Prk.	R	2	.004 ± .001	2	331	8
70739	Lakeland	R	2	.007 ± .002	4	690	13
70740	Lakeland	R	2	.026 ± .004	4	651	12
70742	Lakeland	R	2	.010 ± .001	2	248	13
70743	Lakeland	R	2	Invalid	--	--	20
70746	Lakeland	R	2	.005 ± .001	4	451	10
70751	Lakeland	R	2	.047 ± .027	4	299	9
70752	Lakeland	R	3	.006 ± .004	2	233	12
70755	Lakeland	U	2	Invalid	0	0	12
70761	Lakeland	R	2	Invalid	2	84	11
70766	Mulberry	R	2	.013 ± .000	3	466	19
70778	Lakeland	R	2	.007 ± .003	3	426	7
70779	Mulberry	R	2	Terminated	1	49	18
70781	Mulberry	R	2	.003 ± .001	4	528	11
70786	Mulberry	R	2	.009 ± .004	3	434	10
70787	Mulberry	R	2	.002 ± .001	2	209	10
70788	Mulberry	R	2	Terminated	1	80	12
70790	Mulberry	R	2	.033 ± .014	3	249	10
70792	Mulberry	R	2	.004 ± .002	3	221	13
70793	Mulberry	R	2	.004 ± .000	3	252	12

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70794	Mulberry	R	3	Terminated	1	166	21
70795	Mulberry	R	2	.010 ± .005	3	247	11
70796	Mulberry	R	2	.009 ± .003	4	220	12
70797	Mulberry	R	2	.014 ± .004	3	314	23
70799	Mulberry	R	2	.034 ± .009	4	370	10
70802	Mulberry	R	2	.011 ± .006	4	456	16
70803	Mulberry	R	3	.007 ± .003	4	495	20
70804	Mulberry	R	2	.006 ± .001	4	582	8
70805	Mulberry	R	4	Terminated	1	167	14
70806	Mulberry	R	2	.010 ± .003	4	433	8
70816	Lakeland	R	2	.010 ± .002	4	694	8
70818	Lakeland	R	2	.012 ± .007	2	160	7
70821	Lakeland	R	4	Terminated	1	166	5
70823	Mulberry	R	4	.003 ± .001	3	162	16
70825	Mulberry	R	3	.013 ± .010	2	193	10
70826	Mulberry	R	3	.010 ± .002	4	422	14
70827	Mulberry	R	3	.049 ± .025	3	507	13
70832	Mulberry	R	3	.004 ± .000	4	601	19
70854	Ft. Meade	R	4	.011 ± .003	4	570	13
70873	Lakeland	R	2	.006 ± .001	4	560	8
70877	Lakeland	R	2	.014 ± .002	4	745	17
70882	Lakeland	R	2	.007 ± .001	4	572	11

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70885	Lakeland	R	2	Invalid	1	91	11
70892	Lakeland	R	2	.008 ± .002	3	510	11
70893	Mulberry	R	4	.005 ± .000	3	472	13
70895	Mulberry	R	3	.005 ± .000	3	533	24
70901	Mulberry	R	2	.034 ± .012	4	498	10
70911	Bartow	R	3	.007 ± .003	3	358	11
70912	Bartow	R	2	.015 ± .005	4	318	10
70913	Bartow	R	1	.037 ± .005	4	261	10
70914	Bartow	R	2	.051 ± .009	3	265	9
70915	Bartow	R	2	.026 ± .002	4	404	9
70916	Bartow	R	2	.027 ± .005	3	215	10
70919	Bartow	R	2	.007 ± .003	2	450	10
70920	Bartow	R	2	Invalid	0	---	9
70921	Bartow	R	2	.030 ± .012	2	233	10
70937	Mulberry	R	2	.007 ± .002	3	389	10
70942	Lakeland	R	2	.010 ± .003	3	148	8
70944	Lakeland	U	4	.002 ± .000	2	305	9
70945	Eaton Prk	R	4	.012 ± .008	2	194	23
70946	Eaton Prk	R	4	.008 ± .004	3	286	16
70952	Eaton Prk	R	4	.035 ± .024	4	530	25
70953	Lakeland	R	2	.029 ± .009	2	328	15
70956	Lakeland	U	2	Terminated	1	164	8

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE

INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
70958	Lakeland	R	2	.018 ± .004	4	551	14
70972	"	N	2	.004 ± .000	2	254	6
70973	"	N	2	Terminated	1	66	5
70982	Ft. Meade	U	4	.014 ± .002	2	259	6
70986	Davenport	N	2	.003 ± .001	3	430	6
71001	Lakeland	N	2	Terminated	1	173	6
71008	Polk City	N	2	.003 ± .000	2	336	6
71013	"	N	2	.004 ± .001	4	573	6
71017	"	N	2	Terminated	1	96	7
71019	"	N	2	.002± .001	4	760	7
71023	Davenport	N	2	.004 ± .003	3	355	5
71031	Haines Cy	N	2	Terminated	1	37	5
71034	"	N	2	.003 ± .001	4	465	6
71035	"	N	2	.001 ± .000	4	633	6
71036	"	N	2	.005 ± .002	4	355	5
71042	Haines Cy	N	2	.004 ± .001	2	177	5
71047	"	N	3	.004 ± .001	3	429	5
71054	"	N	2	.003 ± .001	4	469	6
71058	Haines Cy	N	2	.003 ± .001	3	171	7
71059	"	N	2	.004 ± .001	3	233	6
71061	Haines Cy	N	3	Terminated	1	167	6

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
71063	Haines City	N	3	.002±.000	4	632	5
71064	Haines City	N	2	.012±.002	3	503	5
71066	Haines City	N	2	.003±.001	4	631	5
71085	Polk City	N	2	Invalid	1	62	6
71096	Dundee	N	2	.004±.001	4	573	6
71113	Dundee	N	2	.003±.000	4	524	9
71116	Lake Wales	N	2	.008±.006	3	181	5
71126	Lake Wales	N	2	Invalid	1	47	5
71139	Lake Wales	N	2	.004±.001	4	647	5
71143	Lake Wales	N	2	.003±.001	4	406	5
71156	Bartow	N	2	Terminated	1	101	5
71168	Winter Haven	N	2	.002±.001	4	572	5
71176	Frostproof	N	2	Terminated	0	---	9
71196	Lakeland	M	2	.022±.010	4	462	9
71206	Lakeland	M	2	.020±.009	4	356	7
71251	Winter Haven	N	2	.006±.005	2	206	5
71266	Bartow	N	2	.005±.001	3	395	5
71271	Winter Haven	N	2	.005±.002	4	211	5
71276	Winter Haven	N	2	Invalid	2	67	5

ATTACHMENT 1

RESULTS OF MEASUREMENTS BY THE
INTEGRATING RADON DAUGHTER SAMPLER

Loc. No.	City	Land Class	Structure Type	Mean WL	No. of Valid Samples	Total Run Time/Hrs	Mean Outside Gamma
71345	Lithia	M	2	.003±.001	2	219	6
71371	Winter Haven	N	2	.004±.001	4	674	5
71377	Auburndale	N	2	.007±.001	3	459	6
71380	Auburndale	N	3	.003±.001	4	506	6
71394	Ft. Meade	M	3	Terminated	1	252	9
71397	Ft. Meade	M	4	.010±.002	4	397	7

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 401	Lakeland	R	2	2	Lost	----
70 402	"	R	4	2	0.87	.008
70 403	"	R	4	2	0.52	.008
70 404	Lakeland	R	4	2	0.52	.008
70 405	"	R	4	2	0.87	.008
70 406	"	R	4	2	0.69, 1.74	.008
70 407	Lakeland	R	4	2	3.65	.010
70 408	"	R	4	2	Lost	----
70 409	"	R	4	2	2.60	.009
70 410	Lakeland	R	4	2	3.99	.011
70 411	"	R	4	2	1.74, 2.43	.008
70 412	"	R	4	2	2.26	.008
70 413	Lakeland	R	4	2	0.87	.008
70 414	"	R	4	2	1.91	.008
70 415	"	R	4	2	Lost	----
70 416	Lakeland	R	4	2	0.17, 0.87	.008
70 417	"	R	4	2	4.17	.011
70 418	"	R	4	2	1.91	.008
70 419	Lakeland	R	4	2	1.22	.008
70 420	"	R	4	2	Lost	----
70 421	"	R	4	2	1.74, 1.22	.008
70 422	Lakeland	R	4	2	0.69	.008
70 423	"	R	4	2	Lost	----
70 424	"	R	4	2	0.69	.008
70 425	Lakeland	R	4	----	1.04	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 426	Lakeland	R	4	---	2.6	.009
70 427	"	R	4	---	1.74, 1.39	.008
70 428	"	R	4	---	0.52	.008
70 429	Lakeland	U	4	---	0.69	.012
70 430	"	U	4	---	2.43	.013
70 431	"	U	4	---	0.35	.012
70 432	Lakeland	U	4	---	0.35, 0.87	.012
70 433	"	R	4	2	0.52	.008
70 434	"	R	4	2	1.74	.008
70 435	Lakeland	R	4	2	Lost	---
70 436	"	R	4	2	0.0, 0.52	.008
70 437	"	R	4	2	0.69	.008
70 438	Lakeland	R	4	2	0.52	.008
70 439	"	R	4	---	Lost	---
70 440	"	R	4	---	Lost	---
70 441	Lakeland	R	4	---	1.22, 1.39	.008
70 442	"	R	4	---	6.42	.014
70 443	"	R	4	---	4.17	.011
70 444	Lakeland	R	4	---	1.39	.008
70 445	"	R	4	---	0.69	.008
70 446	"	R	4	---	2.26, 2.60	.009
70 447	Lakeland	R	4	2	1.91	.008
70 448	"	R	4	2	2.26	.008
70 449	"	R	4	2	0.87	.008
70 450	"	R	4	2	1.04	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 451	Lakeland	R	4	2	0.35, 0.87	.008
70 452	"	R	4	---	0.87	.008
70 453	"	R	4	---	0.69	.008
70 454	Lakeland	R	4	---	1.56	.008
70 455	"	R	4	---	1.22	.008
70 456	"	R	4	---	3.99, 6.08	.012
70 457	Lakeland	R	4	---	Lost	---
70 458	"	R	4	---	1.91	.008
70 459	"	R	4	---	1.39	.008
70 460	Lakeland	R	4	---	0.52	.008
70 461	"	R	4	---	1.39, 0.35	.008
70 462	"	R	4	---	1.56	.008
70 463	Lakeland	R	4	---	4.34	.011
70 464	"	R	4	---	4.17	.011
70 465	"	R	4	---	2.43	.009
70 466	Lakeland	R	4	---	0.69, 0.35	.008
70 467	"	R	4	---	1.56	.008
70 468	"	R	4	---	1.22	.008
70 469	Lakeland	R	4	---	1.39	.008
70 470	"	R	4	---	1.74	.008
70 471	"	R	4	---	0.87, 0.52	.008
70 472	Lakeland	R	4	---	Lost	---
70 473	"	R	4	---	0.52	.008
70 474	"	R	4	---	0.69	.008
70 475	Lakeland	R	4	---	0.69	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 476	Lakeland	R	4	----	0.87, 0.35	.008
70 477	"	R	4	----	1.04	.008
70 478	"	R	4	----	2.95	.009
70 479	"	R	4	----	3.99	.011
70 480	"	R	4	----	2.43	.009
70 481	"	R	4	----	5.90, 5.73	.014
70 482	Lakeland	R	4	----	2.08	.008
70 483	"	R	4	----	1.39	.008
70 484	"	R	4	----	1.22	.008
70 485	Lakeland	R	4	----	1.56	.008
70 486	"	R	4	----	1.04, 0.52	.008
70 487	"	R	4	----	0.35	.008
70 488	Lakeland	R	4	----	0.35	.008
70 489	"	R	4	----	1.04	.008
70 490	"	R	4	----	2.43	.009
70 491	Lakeland	R	4	----	0.87, 0.35	.008
70 492	"	R	4	----	0.17	.008
70 493	"	R	4	----	.087	.008
70 494	Lakeland	R	4	----	1.56	.008
70 495	"	R	4	----	2.08	.008
70 496	"	R	4	----	0.87, 2.95	.009
70 497	Lakeland	R	4	----	1.56	.008
70 498	"	R	4	----	3.82	.011
70 499	"	R	4	----	3.12	.010
70 500	Lakeland	R	4	----	1.04	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 501	Lakeland	R	4	----	1.91	.008
70 502	"	R	4	----	Lost	----
70 503	"	R	4	----	4.86	.012
70 504	Lakeland	R	4	---	Lost	----
70 505	"	R	4	----	1.39	.008
70 506	"	R	4	----	1.04, 1.04	.008
70 507	Lakeland	R	4	----	1.56	.008
70 508	"	R	4	----	1.39	.008
70 509	"	R	4	----	1.39	.008
70 510	Lakeland	R	4	----	Lost	----
70 511	"	R	4	----	3.12, 2.60	.009
70 512	"	R	4	----	1.39	.008
70 513	"	R	4	----	1.91	.008
70 514	Lakeland	R	4	----	2.43	.009
70 515	"	R	4	----	0.87	.008
70 516	"	R	4	----	1.91, 0.52	.008
70 517	Lakeland	R	4	----	0.87	.008
70 518	"	R	4	----	0.69	.008
70 519	Lakeland	R	4	----	Lost	----
70 520	"	R	4	----	2.95	.009
70 521	"	R	4	----	0.17, 1.04	.008
70 522	Lakeland	R	4	----	0.69	.008
70 523	"	R	4	----	1.74	.008
70 524	"	R	4	----	Lost	----
70 525	Lakeland	R	4	----	1.56	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 526	Lakeland	R	4	----	2.78, 1.22	.009
70 527	"	R	4	----	2.60	.009
70 528	"	R	4	----	1.39	.008
70 529	Lakeland	R	4	----	0.87	.008
70 530	"	R	4	----	Lost	----
70 531	"	R	4	----	2.08, 2.60	.009
70 532	Lakeland	R	4	----	5.03	.012
70 533	"	R	2	----	3.65	.014
70 534	"	R	2	----	0.87	.012
70 535	Lakeland	R	2	----	5.38	.016
70 536	"	R	4	----	10.42, 8.16	.019
70 537	"	R	2	2	Lost	----
70 538	Lakeland	R	2	2	Lost	----
70 539	"	R	2	16	18.75	.030
70 540	"	R	2	16	6.60	.025
70 541	Lakeland	R	2	16	14.06, 13.89	.025
70 542	"	R	2	16	1.04	.014
70 543	"	R	2	16	10.07	.022
70 544	Lakeland	R	2	2	Lost	----
70 545	"	R	2	2	19.27	.033
70 546	"	R	2	16	14.76, 10.59	.024
70 547	Lakeland	R	2	16	Lost	----
70 548	"	R	2	2	12.67	.025
70 549	"	R	2	2	3.47	.014
70 550	Lakeland	R	2	2	1.39	.012

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 551	Lakeland	R	2	2	4.51, 5.90	.016
70 552	"	R	2	2	0.87	.012
70 553	"	R	2	2	2.43	.013
70 554	Lakeland	R	2	16	22.57	.033
70 555	"	R	2	2	4.69	.015
70 556	"	R	2	2	6.77, 8.33	.019
70 557	Lakeland	R	2	2	2.95	.013
70 558	"	R	2	2	52.60	.074
70 559	"	R	2	2	2.78	.013
70 560	Lakeland	R	2	2	0.0	---
70 561	"	R	2	2	42.01, 31.25	.054
70 562	"	R	2	2	4.51	.015
70 563	Lakeland	R	2	2	4.51	.015
70 564	"	R	2	2	Lost	----
70 565	"	R	2	2	8.16	.020
70 566	Lakeland	R	2	2	16.67, 12.33	.027
70 567	"	R	2	2	8.16	.020
70 568	"	R	2	2	15.97	.029
70 569	Lakeland	R	2	2	2.08	.012
70 570	"	R	2	2	4.34	.015
70 571	"	R	2	2	4.34, 3.82	.015
70 572	Lakeland	R	2	2	2.26	.012
70 573	"	R	2	2	0.87	.012
70 574	"	R	2	2	1.56	.012
70 575	Lakeland	R	2	2	6.08	.017

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 576	Lakeland	R	2	2	4.66, 3.82	.015
70 577	"	R	2	2	20.48	.035
70 578	"	R	2	2	31.25	.048
70 579	Lakeland	R	2	2	2.26	.012
70 580	"	R	2	2	6.08	.017
70 581	"	R	2	2	5.03, 5.56	.016
70 582	Lakeland	R	2	2	17.53	.031
70 583	"	R	2	2	1.04	.012
70 584	"	R	2	16	Lost	----
70 585	Lakeland	R	2	16	11.98	.023
70 586	"	R	2	16	8.68, 8.16	.020
70 587	"	R	2	16	3.99	.016
70 588	Lakeland	R	2	16	Lost	----
70 589	"	R	2	16	14.41	.026
70 590	"	R	2	16	11.28	.023
70 591	Lakeland	R	2	16	2.08, 2.26	.014
70 592	"	R	2	16	9.20	.021
70 593	"	R	2	16	Lost	----
70 594	Lakeland	R	2	16	6.94	.019
70 595	"	R	2	16	1.91	.014
70 596	"	R	2	16	5.73, 3.99	.017
70 597	Lakeland	R	2	16	2.95	.015
70 598	"	R	2	16	1.39	.014
70 599	"	R	2	16	Lost	----
70 600	Lakeland	R	2	16	10.94	.022

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 601	Lakeland	R	2	16	Lost	----
70 602	"	R	2	16	1.22	.014
70 603	"	R	2	16	3.47	.015
70 604	Lakeland	R	2	16	2.60	.015
70 605	"	R	2	16	2.78	.015
70 606	"	R	2	16	7.64, 6.77	.019
70 607	Lakeland	R	2	16	3.12	.015
70 608	"	R	2	16	16.14	.027
70 609	"	R	2	16	7.12	.019
70 610	Lakeland	R	2	16	8.51	.020
70 611	"	R	2	16	2.26, 0.69	.014
70 612	"	R	2	16	7.12	.019
70 613	Lakeland	R	2	16	1.74	.014
70 614	"	R	2	16	0.69	.014
70 615	"	R	2	16	3.47	.015
70 616	Lakeland	R	2	16	Lost	----
70 617	"	R	2	16	5.38	.017
70 618	"	R	2	16	5.38	.017
70 619	Lakeland	R	2	16	5.38	.017
70 620	"	R	2	16	13.54	.025
70 621	"	R	2	16	Lost	----
70 622	Lakeland	R	2	16	11.80	.023
70 623	"	R	2	16	5.90	.018
70 624	"	R	2	16	10.24	.022
70 625	Lakeland	R	2	16	5.56	.017

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 626	Lakeland	R	2	16	9.37, 7.12	.020
70 627	"	R	2	16	Lost	----
70 628	"	R	2	16	6.08	.018
70 629	Lakeland	R	2	16	4.34	.016
70 630	"	R	2	16	3.47	.015
70 631	"	R	2	16	11.98, 12.50	.024
70 632	Lakeland	R	2	16	14.24	.025
70 633	"	R	2	16	3.12	.015
70 634	"	R	2	16	7.46	.019
70 635	Lakeland	R	2	16	1.56	.014
70 636	"	R	2	16	3.12, 3.12	.015
70 637	"	R	2	16	1.91	.014
70 638	Lakeland	R	2	16	7.29	.019
70 639	"	R	2	16	3.47	.015
70 640	"	R	2	2	Lost	----
70 641	Lakeland	R	2	2	2.95, 2.43	.013
70 642	"	R	2	2	8.16	.020
70 643	"	R	2	16	20.83	.032
70 644	Lakeland	R	2	16	3.30	.015
70 645	"	R	2	16	2.43	.015
70 646	"	R	2	16	Lost	----
70 647	Lakeland	R	2	16	6.08	.018
70 648	"	R	2	16	6.42	.018
70 649	"	R	2	16	3.65	.016
70 650	Lakeland	R	2	16	Lost	----

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 651	Lakeland	R	2	16	5.03, 3.30	.016
70 652	"	R	2	16	3.82	.016
70 653	"	R	2	16	0.17	.014
70 654	Lakeland	R	2	16	2.26	.014
70 655	"	R	2	16	1.91	.014
70 656	"	R	2	16	1.04, 1.39	.014
70 657	Lakeland	R	2	16	1.56	.014
70 658	"	R	2	16	4.86	.017
70 659	"	R	2	16	3.82	.016
70 660	Lakeland	R	2	16	2.60	.015
70 661	"	R	2	16	5.56, 6.08	.018
70 662	"	R	2	16	15.03	.026
70 663	Lakeland	R	2	16	0.17	.014
70 664	"	R	2	16	3.65	.016
70 665	"	R	2	16	4.86	.017
70 666	Lakeland	R	2	16	2.08, 2.60	.014
70 667	"	R	2	16	2.60	.015
70 668	"	R	2	16	3.99	.016
70 669	Lakeland	R	2	16	Lost	----
70 670	"	R	2	16	1.39	.014
70 671	"	R	2	16	7.81, 6.42	.019
70 672	Lakeland	R	2	16	1.91	.014
70 673	"	R	2	16	0.35	.014
70 674	"	R	2	16	1.56	.014
70 675	Lakeland	R	2	16	1.22	.014

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less than
70 676	Lakeland	R	2	16	5.38, 5.56	.017
70 677	"	R	2	16	0.52	.014
70 678	"	R	2	16	3.99	.016
70 679	Lakeland	R	2	16	5.90	.018
70 680	"	R	2	16	1.04	.014
70 681	"	R	2	16	3.47, 4.86	.016
70 682	Lakeland	R	2	16	1.04	.014
70 683	"	R	2	16	3.65	.016
70 684	"	R	2	16	1.91	.014
70 685	Lakeland	R	2	16	6.94	.019
70 686	"	R	2	16	Lost	----
70 687	"	R	2	16	3.30	.015
70 688	Lakeland	R	4	2	2.60	.009
70 689	"	R	4	2	1.56	.008
70 690	"	R	2	2	5.56	.016
70 691	Lakeland	R	4	2	Lost	----
70 692	"	R	4	2	1.22	.008
70 693	"	R	4	2	1.74	.008
70 694	Lakeland	R	2	16	9.37	.021
70 695	"	R	2	16	9.20	.021
70 696	"	R	4	2	Lost	----
70 697	Lakeland	R	4	2	Lost	----
70 698	"	R	4	2	5.38	.013
70 699	"	R	4	2	3.99	.011
70 700	Lakeland	R	4	2	Lost	----

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 701	Lakeland	R	4	2	2.08, 2.78	.009
70 702	"	R	4	2	1.91	.008
70 703	"	R	4	2	7.29	.016
70 704	Lakeland	R	4	2	3.82	.011
70 705	"	R	4	2	5.56	.013
70 706	"	R	4	2	Lost	----
70 707	Lakeland	R	2	-	0.69	.012
70 708	"	R	2	-	12.33	.025
70 709	"	R	2	-	45.48	.065
70 710	Lakeland	R	2	-	11.98	.024
70 711	"	R	4	2	3.99, 1.91	.009
70 712	"	R	4	2	3.47	.010
70 713	Lakeland	R	4	16	8.85	.018
70 714	"	R	4	16	3.30	.010
70 715	"	R	4	16	8.68	.018
70 716	Lakeland	R	2	16	Lost	----
70 717	"	R	4	16	9.37	.019
70 718	"	R	2	-	9.03	.021
70 719	Lakeland	R	2	-	Lost	----
70 720	"	R	2	16	Lost	----
70 721	"	R	2	16	2.78, 1.74	.014
70 722	Lakeland	R	2	16	5.36	.017
70 723	"	R	4	-	5.21	.013
70 724	"	R	4	-	6.60	.015
70 725	Lakeland	R	4	16	8.85	.018

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70726	Lakeland	R	4	16	6.60, 6.42	.015
70 727	Lakeland	R	4	16	0.52	.008
70 728	Eaton Park	R	2	16	9.03	.021
70 729	Eaton Park	R	4	16	5.90	.014
70 730	Eaton Park	R	2	16	11.28	.023
70 731	Lakeland	R	2	16	4.69, 4.69	.017
70 732	Lakeland	R	4	2	3.82	.011
70 733	Eaton Park	R	2	16	4.69	.017
70 734	Eaton Park	R	2	16	4.86	.017
70 735	Eaton Park	R	2	16	6.60	.018
70 736	Eaton Park	R	2	16	8.16, 5.03	.018
70 737	Eaton Park	R	2	16	7.81	.019
70 738	Eaton Park	R	2	16	5.03	.017
70 739	Lakeland	R	2	2	7.29	.019
70 740	Lakeland	R	2	2	28.12	.044
70 741	Eaton Park	R	2	16	Lost	----
70 742	Lakeland	R	2	2	13.89	.027
70 743	Lakeland	R	2	2	37.32	.055
70 477	Lakeland	R	2	2	26.21	.042
70 745	Lakeland	R	2	2	15.45	.029
70 746	Lakeland	R	2	2	5.21, 3.65	.015
70 747	Eaton Park	R	2	-	11.98	.024
70 748	Eaton Park	R	4	16	6.60	.015
70 749	Eaton Park	R	2	16	5.73	.018
70 750	Lakeland	R	2	2	2.26	.012

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Type	Track Density T/mm^2	Mean WL Less Than
70 751	Lakeland	R	2	2	30.21, 33.68	.049
70 752	Lakeland	R	3	2	7.12	.018
70 753	Lakeland	U	2	-	6.77	.018
70 754	Lakeland	U	2	-	6.08	.017
70 755	Lakeland	U	2	-	4.86	.016
70 756	Ft. Meade	R	4	16	Lost	----
70 757	Lakeland	R	2	2	8.85	.020
70 758	Lakeland	R	2	2	12.50	.025
70 759	Lakeland	R	2	2	5.90	.017
70 760	Lakeland	R	2	2	3.82	.014
70 761	Lakeland	R	2	2	4.17, 4.17	.015
70 762	Lakeland	R	2	2	7.29	.019
70 763	Lakeland	R	2	2	29.16	.045
70 764	Lakeland	R	2	2	5.56	.016
70 765	Lakeland	R	2	2	19.44	.033
70 766	Mulberry	R	2	-	14.06, 11.46	.025
70 767	Mulberry	R	2	-	7.81	.019
70 768	Mulberry	R	2	-	3.65	.014
70 769	Mulberry	R	2	-	7.12	.018
70 770	Lakeland	R	4	2	2.08	.008
70 771	Lakeland	R	4	2	Lost	----
70 772	Lakeland	R	4	2	8.33	.017
70 773	Lakeland	R	4	2	4.17	.011
70 774	Lakeland	R	4	2	2.78	.009
70 775	Lakeland	R	4	-	1.04	.008

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 776	Lakeland	R	4	-	0.17	.008
70 777	Lakeland	R	4	-	2.78	.009
70 778	Lakeland	R	4	-	0.17	.008
70 779	Mulberry	R	2	-	27.60	.043
70 780	Mulberry	R	2	-	3.12	.014
70 781	Mulberry	R	2	-	5.21, 1.01	.016
70 782	Mulberry	R	3	-	3.65	.014
70 783	Mulberry	R	2	-	9.55	.021
70 784	Mulberry	R	2	-	5.73	.017
70 785	Mulberry	R	2	-	5.03	.016
70 786	Mulberry	R	2	-	4.17, 5.38	.016
70 787	Mulberry	R	2	-	8.85	.020
70 788	Mulberry	R	2	-	39.41	.058
70 789	Mulberry	R	2	-	10.59	.023
70 790	Mulberry	R	2	-	11.63	.024
70 791	Mulberry	R	2	-	6.08, 9.37	.019
70 792	Mulberry	R	2	-	2.95	.013
70 793	Mulberry	R	2	-	4.51	.015
70 794	Mulberry	R	3	-	2.78	.013
70 795	Mulberry	R	2	-	12.33	.025
70 796	Mulberry	R	2	-	8.16, 7.29	.019
70 797	Mulberry	R	2	-	33.16	.050
70 798	Mulberry	R	2	-	19.62	.034
70 799	Mulberry	R	2	-	15.80	.029
70 800	Mulberry	R	3	-	2.25	.012

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 801	Mulberry	R	2	-	6.77, 13.44	.022
70 802	Mulberry	R	2	-	15.62	.029
70 803	Mulberry	R	3	2	5.56	.016
70 804	Mulberry	R	2	2	5.21	.016
70 805	Mulberry	R	4	2	5.03	.012
70 806	Mulberry	R	2	16	2.95, 2.43	.015
70 807	Mulberry	R	2	16	4.69	.017
70 808	Mulberry	R	2	48	11.11	.023
70 809	Mulberry	R	2	-	10.24	.022
70 810	Mulberry	R	3	-	4.17	.015
70 811	Mulberry	R	4	2	Lost	----
70 812	Mulberry	R	4	2	6.42	.014
70 813	Mulberry	R	4	2	6.25	.014
70 814	Mulberry	R	4	2	2.78	.009
70 815	Lakeland	R	2	-	5.03	.016
70 816	Lakeland	R	2	-	2.60, 6.25	.015
70 817	Lakeland	R	2	-	6.60	.018
70 818	Lakeland	R	2	-	4.17	.015
70 819	Lakeland	R	2	-	5.56	.016
70 820	Lakeland	R	4	-	1.56	.008
70 821	Lakeland	R	4	-	1.39, 1.74	.008
70 822	Lakeland	R	4	-	2.95	.009
70 823	Mulberry	R	4	2	2.60	.009
70 824	Mulberry	R	4	2	2.43	.009
70 825	Mulberry	R	3	-	1.91	.012

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Sur face Soil	Track Density T/mm2	Mean WL Less Than
70 826	Mulberry	R	3	---	9.37, 8.16	.020
70 827	Mulberry	R	3	---	24.65	.040
70 828	Mulberry	R	3	---	12.67	.025
70 829	Mulberry	R	3	----	3.47	.014
70 830	Mulberry	R	2	2	13.54	.026
71 831	Mulberry	R	3	2	5.38, 5.38	.016
70 832	Mulberry	R	3	2	3.47	.014
70 833	Mulberry	R	4	2	4.34	.011
70 834	Pierce	R	2	48	3.65	.014
70 835	Mulberry	R	2	48	7.29	.019
70 836	Mulberry	R	2	48	Lost	----
70 837	Lakeland	R	4	----	0.69	.008
70 838	Lakeland	R	4	----	4.86	.012
70 839	Lakeland	R	4	----	4.86	.012
70 840	Lakeland	R	4	----	Lost	----
70 841	Lakeland	R	4	----	Lost	----
70 842	Lakeland	R	4	----	3.30	.010
70 843	Lakeland	R	4	----	5.90	.014
70 844	Pierce	R	2	----	40.45	.059
70 845	Bradley	R	3	----	2.76	.013
70 846	Ft. Meade	R	4	----	12.85, 13.71	.024
70 847	Lakeland	R	2	2	9.03	.021
70 848	Lakeland	R	2	16	26.04	.036
70 849	Lakeland	R	2	16	2.95	.015
70 850	Lakeland	R	2	16	19.44	.030

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 851	Lakeland	R	2	16	2.08, 2.95	.015
70 852	Ft. Meade	R	2	16	8.68	.020
70 853	Ft. Meade	R	2	16	Lost	----
70 854	Ft. Meade	R	4	16	8.33	.017
70 855	Ft. Meade	R	2	16	16.32	.027
70 856	Mulberry	R	2	-	Lost	----
70 857	Mulberry	R	2	-	14.24	.027
70 858	Mulberry	R	2	-	10.07	.022
70 859	Mulberry	R	2	-	4.51	.015
70 860	Mulberry	R	2	-	Lost	----
70 861	Mulberry	R	2	-	9.37, 15.28	.025
70 862	Mulberry	R	2	-	15.97	.029
70 863	Mulberry	R	2	-	20.31	.034
70 864	Lakeland	R	2	16	17.53	.028
70 865	Lakeland	R	2	16	Lost	----
70 866	Lakeland	R	2	16	27.93, 11.63	.031
70 867	Lakeland	R	2	2	13.54	.026
70 868	Lakeland	R	2	2	5.38	.016
70 869	Lakeland	R	1	0	9.90	.022
70 870	Lakeland	R	1	0	7.99	.019
70 871	Lakeland	R	1	0	4.34, 3.65	.015
70 872	Lakeland	R	2	16	5.56	.017
70 873	Lakeland	R	2	16	3.99	.016
70 874	Lakeland	R	2	16	6.08	.018
70 875	Lakeland	R	2	16	4.86	.017

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 876	Lakeland	R	2	16	3.99, 3.65	.016
70 877	"	R	2	16	24.82	.035
70 878	"	R	2	2	16.49	.030
70 879	Lakeland	R	2	2	15.28	.028
70 880	"	R	2	16	18.05	.029
70 881	"	R	2	16	9.37, 9.55	.021
70 882	Lakeland	R	2	16	7.99	.020
70 883	"	R	2	16	3.65	.016
70 884	"	R	2	16	5.90	.018
70 885	Lakeland	R	2	16	3.99	.016
70 886	"	R	2	16	6.25, 5.03	.017
70 887	"	R	2	16	Lost	----
70 888	Lakeland	R	2	16	2.08	.014
70 889	"	R	2	16	4.34	.016
70 890	"	R	2	16	2.26	.014
70 891	Lakeland	R	2	16	4.51	.016
70 892	Lakeland	R	2	16	5.56, 4.17	.017
70 893	Mulberry	R	4	2	4.51	.012
70 894	Mulberry	R	4	2	5.38	.016
70 895	Mulberry	R	3	-	5.73	.017
70 896	Mulberry	R	4	-	8.16, 4.51	.014
70 897	Mulberry	R	4	-	3.99	.011
70 898	Lakeland	R	2	2	20.14	.034
70 899	Lakeland	R	2	2	7.99	.019
70 900	Mulberry	R	2	-	8.85	.020

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 901	Mulberry	R	2	-	18.23, 19.27	.033
70 902	"	R	2	-	18.75	.033
70 903	"	R	3	-	3.65	.014
70 904	Mulberry	R	3	-	3.99	.015
70 905	"	R	3	-	2.60	.013
70 906	"	R	4	-	Lost	----
70 907	Mulberry	R	4	-	1.56	.008
70 908	"	R	4	-	3.82	.011
70 909	"	R	4	-	5.03	.012
70 910	Mulberry	R	2	-	8.16	.020
70 911	Bartow	R	3	-	5.56, 6.25	.017
70 912	"	R	2	-	29.34	.045
70 913	"	R	1	-	36.88	.055
70 914	Bartow	R	2	-	72.39	.098
70 915	"	R	2	-	34.55	.052
70 916	"	R	2	-	27.26, 21.35	.039
70 917	Bartow	R	3	-	9.72	.022
70 918	"	R	2	-	11.80	.024
70 919	"	R	2	-	Lost	----
70 920	Bartow	R	2	-	11.80	.024
70 921	"	R	2	2	22.74, 19.44	.035
70 922	"	R	2	2	27.60	.043
70 923	Bartow	R	2	2	35.07	.052
70 924	"	R	2	2	36.11	.054
70 925	Bartow	R	2	2	27.95	.044

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 926	Bartow	R	3	-	15.28, 17.71	.030
70 927	Bartow	R	2	-	38.71	.057
70 928	Bartow	R	2	-	26.73	.042
70 929	Bartow	R	2	2	11.11	.023
70 930	Lakeland	R	2	2	5.21	.016
70 931	Lakeland	R	2	2	Lost	----
70 932	Lakeland	R	2	16	21.53	.032
70 933	Lakeland	R	2	16	33.85	.044
70 934	Lakeland	R	2	16	3.30	.015
70 935	Lakeland	R	2	16	20.14	.031
70 936	Lakeland	R	2	16	14.06, 14.41	.025
70 937	Mulberry	R	2	-	9.55	.021
70 938	Lakeland	R	2	2	10.94	.023
70 939	Lakeland	R	2	2	14.93	.028
70 940	Lakeland	R	2	2	17.53	.031
70 941	Lakeland	R	2	16	4.86, 4.86	.017
70 942	Lakeland	R	2	16	6.60	.018
70 943	Lakeland	U	4	-	8.51	.020
70 944	Lakeland	U	4	-	Lost	----
70 945	Eaton Park	R	4	16	11.8	.022
70 946	Eaton Park	R	4	16	5.38, 9.55	.016
70 947	Lakeland	R	4	16	7.46	.016
70 948	Lakeland	R	4	16	7.81	.016
70 949	Lakeland	R	4	16	Lost	----
70 950	Lakeland	U	2	-	29.34	.045

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
70 951	Eaton Park	R	2	16	4.17, 4.69	.016
70 952	Eaton Park	R	4	16	21.01	.035
70 953	Lakeland	R	2	2	18.58	.032
70 954	Mulberry	R	2	2	11.28	.023
70 955	Mulberry	R	3	-	3.82	.014
70 956	Lakeland	U	2	-	3.30, 2.26	.013
70 957	Mulberry	U	4	-	Lost	----
70 958	Lakeland	R	2	2	17.88	.031
70 959	Lakeland	U	2	-	9.03	.021
70 960	Lakeland	U	2	-	5.03	.016
70 961	Lakeland	N	2	1	7.29, 10.76	.009
70 962	"	N	2	1	3.12	.006
70 963	"	N	2	1	3.12	.006
70 964	Lakeland	N	2	1	6.25	.008
70 965	"	N	2	1	1.74	.006
70 966	"	N	2	1	4.34, 3.65	.007
70 967	Lakeland	N	2	1	7.29	.008
70 968	"	N	2	1	3.99	.007
70 969	"	N	2	1	1.74	.006
70 970	Lakeland	N	2	1	3.99	.007
70 971	"	N	2	1	3.99, 3.99	.007
70 972	"	N	2	1	4.34	.007
70 973	Lakeland	N	2	1	4.86	.007
70 974	"	N	2	1	10.94	.010
70 975	Lakeland	N	2	1	2.60	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
70 976	Lakeland	N	2	1	3.82, 3.12	.007
70 977	Lakeland	N	2	1	7.99	.009
70 978	Lakeland	N	2	1	3.99	.007
70 979	Bartow	U	2	-	16.32	.030
70 980	Bartow	U	2	-	12.85	.025
70 981	Bartow	U	2	-	24.82, 34.89	.046
70 982	Ft. Meade	U	4	1	10.59	.023
70 983	Bartow	U	2	-	21.70	.036
70 984	Bartow	U	2	-	17.01	.030
70 985	Bartow	U	2	-	17.19	.031
70 986	Davenport	N	2	1	3.65, 3.47	.007
70 987	Davenport	N	3	1	1.91	.006
70 988	"	N	2	1	2.78	.006
70 989	"	N	2	1	2.08	.006
70 990	Davenport	N	2	1	2.26	.006
70 991	"	N	2	1	4.69, 5.73	.007
70 992	"	N	2	-	Lost	----
70 993	Davenport	N	2	-	3.99	.007
70 994	"	N	2	-	1.56	.006
70 995	"	N	2	-	Lost	----
70 996	Davenport	N	2	1	1.91, 0.87	.006
70 997	"	N	3	1	1.56	.006
70 998	"	N	2	1	Lost	----
70 999	Davenport	N	2	1	3.82	.007
71 000	Davenport	N	3	1	2.26	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 001	Lakeland	N	2	1	3.30, 2.08	.006
71 002	Lakeland	N	2	-	3.65	.007
71 003	Lakeland	N	2	-	3.12	.006
71 004	Lakeland	N	2	-	2.43	.006
71 005	Lakeland	N	2	-	3.30	.006
71 006	Lakeland	N	2	-	Lost	----
71 007	Gibsonia	N	2	-	4.51	.007
71 008	Polk City	N	2	1	3.47	.007
71 009	Polk City	N	2	1	2.60	.006
71 010	Polk City	N	3	1	2.60	.006
71 011	Polk City	N	2	1	0.69, 1.04	.006
71 012	Polk City	N	2	1	3.30	.006
71 013	Polk City	N	2	1	4.34	.007
71 014	Polk City	N	2	1	3.30	.006
71 015	Polk City	N	2	1	3.30	.006
71 016	Polk City	N	2	1	2.26, 1.74	.006
71 017	Polk City	N	2	1	2.43	.006
71 018	Polk City	N	1	1	4.86	.007
71 019	Polk City	N	2	1	3.47	.007
71 020	Polk City	N	2	1	7.81	.009
71 021	Davenport	N	2	1	2.95, 1.74	.006
71 022	Davenport	N	2	1	2.26	.006
71 023	Davenport	N	2	1	2.95	.006
71 024	Davenport	N	2	1	1.56	.006
71 025	Davenport	N	2	1	4.17	.007

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 026	Davenport	N	2	1	3.82, 4.69	.007
71 027	Davenport	N	2	1	3.12	.006
71 028	Davenport	N	2	1	2.60	.006
71 029	Davenport	N	3	1	.069	.006
71 030	Davenport	N	2	1	3.12	.006
71 031	Haines City	N	2	1	4.69, 2.26	.007
71 032	Haines City	N	2	1	1.04	.006
71 033	Haines City	N	2	1	2.43	.006
71 034	Haines City	N	2	1	2.26	.006
71 035	Haines City	N	2	1	2.43	.006
71 036	Haines City	N	2	1	2.78, 3.30	.006
71 037	Haines City	N	2	1	2.78	.006
71 038	Haines City	N	2	1	2.78	.006
71 039	Haines City	N	2	1	4.69	.007
71 040	Haines City	N	2	1	Lost	----
71 041	Haines City	N	2	1	Lost	----
71 042	Haines City	N	2	1	3.65	.007
71 043	Haines City	N	2	1	4.86	.007
71 044	Haines City	N	3	1	Lost	----
71 045	Haines City	N	2	1	5.03	.007
71 046	Haines City	N	2	1	Lost	----
71 047	Haines City	N	2	1	2.43	.006
71 048	Haines City	N	2	1	3.47	.007
71 049	Haines City	N	2	1	3.30	.006
71 050	Haines City	N	3	1	2.08	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 051	Haines City	N	2	1	2.60, 2.60	.006
71 052	Haines City	N	2	1	Lost	----
71 053	Haines City	N	2	1	2.08	.006
71 054	Haines City	N	2	1	1.22	.006
71 055	Haines City	N	2	1	1.39	.006
71 056	Haines City	N	2	1	4.69, 5.93	.007
71 057	Haines City	N	2	1	Lost	---
71 058	Haines City	N	2	1	1.39	.006
71 059	Haines City	N	2	1	3.65	.007
71 060	Haines City	N	2	1	6.08	.008
71 061	Haines City	N	3	1	4.34, 2.26	.006
71 062	Haines City	N	2	1	4.86	.007
71 063	Haines City	N	3	1	3.12	.006
71 064	Haines City	N	2	1	20.14	.015
71 065	Haines City	N	2	1	1.39	.006
71 066	Haines City	N	2	1	5.73, 3.65	.007
71 067	Frostproof	N	2	1	Lost	----
71 068	Frostproof	N	2	1	0.69	.006
71 069	Frostproof	N	2	1	1.74	.006
71 070	Frostproof	N	2	1	2.60	.006
71 071	Frostproof	N	2	1	2.95, 2.43	.006
71 072	Frostproof	N	2	1	3.30	.006
71 073	Frostproof	N	2	1	6.60	.008
71 074	Frostproof	N	2	1	4.34	.007
71 075	Frostproof	N	2	1	3.12	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 076	Frostproof	N	2	1	4.86, 2.60	.007
71 077	Frostproof	N	3	1	2.60	.006
71 078	Frostproof	N	2	1	4.86	.007
71 079	Frostproof	N	2	1	Lost	----
71 080	Polk City	N	2	1	3.82	.007
71 081	Polk City	N	3	1	Lost	----
71 082	Polk City	N	2	-	3.12	.006
71 083	Polk City	N	2	1	Lost	----
71 084	Polk City	N	3	1	3.82	.007
71 085	Polk City	N	2	1	4.86	.007
71 086	Polk City	N	2	1	2.78, 4.34	.007
71 087	Polk City	N	3	1	1.22	.006
71 088	Polk City	N	4	1	1.56	.006
71 089	Polk City	N	4	1	Lost	----
71 090	Polk City	N	2	1	5.56	.008
71 091	Polk City	N	4	1	3.12, 1.29	.006
71 092	Dundee	N	2	1	1.74	.006
71 093	Dundee	N	2	1	1.91	.006
71 094	Dundee	N	2	1	2.43	.006
71 095	Dundee	N	2	1	3.65	.007
71 096	Dundee	N	2	1	4.34, 1.74	.006
71 097	Dundee	N	2	1	5.21	.007
71 098	Dundee	N	2	1	1.91	.006
71 099	Dundee	N	2	1	2.95	.006
71 100	Dundee	N	2	1	3.65	.007

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 101	Dundee	N	1	1	0.52, 0.69	.006
71 103	Dundee	N	3	1	1.74	.006
71 103	Dundee	N	2	1	3.65	.007
71 104	Dundee	N	3	1	Lost	---
71 105	Dundee	N	2	1	3.30	.006
71 106	Dundee	N	2	1	Lost	----
71 107	Dundee	N	3	1	2.43	.006
71 108	Dundee	N	2	1	1.22	.006
71 109	Dundee	N	3	1	Lost	----
71 110	Dundee	N	2	1	Lost	----
71 111	Dundee	N	3	1	1.91	.006
71 112	Dundee	N	2	1	2.26	.006
71 113	Dundee	N	2	1	2.73	.006
71 114	Dundee	N	3	1	1.74	.006
71 115	Lake Wales	N	2	1	4.51	.007
71 116	Lake Wales	N	2	1	5.90, 3.65	.007
71 117	Lake Wales	N	2	1	4.69	.007
71 118	Lake Wales	N	2	1	2.78	.006
71 119	Lake Wales	N	2	1	2.60	.006
71 120	Lake Wales	N	2	1	1.39	.006
71 121	Lake Wales	N	2	1	Lost	----
71 122	Lake Wales	N	2	1	3.65	.007
71 123	Lake Wales	N	2	1	5.56	.008
71 124	Lake Wales	N	2	1	Lost	---
71 125	Lake Wales	N	2	1	4.17	.007

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 126	Lake Wales	N	2	1	1.74, 3.47	.006
71 127	"	N	3	1	Lost	----
71 128	"	N	3	1	Lost	----
71 129	Lake Wales	N	3	1	1.39	.006
71 130	"	N	3	1	2.08	.006
71 131	"	N	4	1	5.38, 4.17	.007
71 132	Lake Wales	N	2	1	4.34	.007
71 133	"	N	2	1	3.65	.007
71 134	"	N	2	1	2.78	.006
71 135	Lake Wales	N	2	1	2.78	.006
71 136	"	N	2	1	3.12, 2.43	.006
71 137	"	N	2	1	2.26	.006
71 138	Lake Wales	N	2	1	3.30	.006
71 139	"	N	2	1	4.34	.007
71 140	"	N	2	1	2.95	.006
71 141	Lake Wales	N	2	1	1.39, 1.91	.006
71 142	"	N	2	1	2.60	.006
71 143	"	N	2	1	2.95	.006
71 144	Lake Wales	N	2	1	2.43	.006
71 145	"	N	2	1	Lost	----
71 146	"	N	2	1	2.78	.006
71 147	"	N	2	1	2.95, 4.17	.007
71 148	Lake Wales	N	2	1	2.95	.006
71 149	Bartow	N	2	1	4.69	.007
71 150	Bartow	N	2	1	3.82	.007

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 151	Bartow	N	2	1	4.69, 3.82	.007
71 152	Bartow	N	2	1	5.56	.008
71 153	Bartow	N	2	1	6.42	.008
71 154	Bartow	N	2	1	Lost	----
71 155	Bartow	N	2	1	3.30	.006
71 156	Bartow	N	2	1	3.30, 5.38	.007
71 157	Bartow	N	2	1	3.12	.006
71 158	Bartow	N	2	1	2.78	.006
71 159	Bartow	N	2	1	3.30	.006
71 160	Bartow	N	2	1	3.99	.007
71 161	Bartow	N	2	1	Lost	----
71 162	Bartow	N	2	1	3.82	.007
71 163	Bartow	N	2	1	1.39	.006
71 164	Winter Haven	N	2	1	2.43	.006
71 165	Winter Haven	N	2	1	2.43	.006
71 166	Winter Haven	N	2	1	2.60	.006
71 167	Winter Haven	N	1	1	1.22, 1.74	.006
71 168	Winter Haven	N	2	1	2.08	.006
71 169	Winter Haven	N	2	1	1.74	.006
71 170	Winter Haven	N	2	1	1.56	.006
71 171	Frostproof	N	2	1	30.55, 23.78	.018
71 172	Frostproof	N	3	1	0.52	.006
71 173	Frostproof	N	2	1	Lost	----
71 174	Frostproof	N	2	1	2.08	.006
71 175	Foostproof	N	2	1	3.30	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 176	Frostproof	N	2	1	2.43, 1.91	.006
71 177	Bartow	N	2	1	30.55	.020
71 178	Frostproof	N	2	1	Lost	----
71 179	Frostproof	N	2	1	1.39	.006
71 180	Frostproof	N	2	1	3.82	.007
71 181	Frostproof	N	2	1	2.60, 4.34	.007
71 182	Frostproof	N	2	1	2.25	.006
71 183	Frostproof	N	2	1	4.17	.007
71 184	Frostproof	N	2	1	3.30	.006
71 185	Frostproof	N	2	1	2.60	.006
71 186	Frostproof	N	2	1	Lost	----
71 187	Frostproof	N	2	1	3.47	.007
71 188	Frostproof	N	2	1	6.25	.008
71 189	Lakeland	M	2	1	11.46	.024
71 190	Lakeland	M	2	1	13.37	.026
71 191	Lakeland	M	2	1	19.96, 20.14	.034
71 192	Lakeland	M	2	1	19.27	.033
71 193	Lakeland	M	2	1	23.26	.038
71 194	Lakeland	M	2	1	Lost	----
71 195	Lakeland	M	2	1	29.69	.046
71 196	Lakeland	M	2	1	Lost	---
71 197	Lakeland	M	2	1	4.51	.015
71 198	Lakeland	M	2	1	7.81	.019
71 199	Lakeland	M	2	1	Lost	----
71 200	Lakeland	M	2	1	13.54	.026

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 201	Lakeland	M	2	1	13.02, 16.14	.027
71 202	"	M	2	1	2.95	.013
71 203	"	M	2	1	8.68	.020
71 204	Lakeland	M	2	1	7.99	.019
71 205	"	M	2	1	8.51	.020
71 206	"	M	2	1	13.37, 11.98	.025
71 207	Lakeland	N	2	1	8.51	.009
71 208	"	M	2	1	13.71	.026
71 209	"	M	2	1	9.37	.021
71 210	Lakeland	M	2	1	5.90	.017
71 211	"	M	2	1	12.67, 10.76	.024
71 212	"	M	2	1	10.76	.023
71 213	Lakeland	M	1	1	13.02	.026
71 214	"	M	2	1	13.71	.026
71 215	"	M	2	1	13.71	.026
71 216	Lakeland	M	2	1	11.28, 11.80	.024
71 217	"	M	2	1	10.76	.023
71 218	"	M	2	1	6.60	.018
71 219	Lakeland	M	2	1	7.12	.018
71 220	"	M	2	1	21.35	.036
71 221	"	M	2	1	10.07, 6.25	.020
71 222	Lakeland	M	2	1	10.07	.022
71 223	"	M	2	1	11.46	.024
71 224	"	M	2	1	6.77	.018
71 225	Lakeland	M	2	1	27.95	.044

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 226	Lakeland	M	2	1	17.36, 20.31	.033
71 227	Lakeland	N	2	1	Lost	----
71 228	Lakeland	M	2	1	17.88	.031
71 229	Lakeland	M	2	1	13.37	.026
71 230	Lakeland	M	2	1	7.81	.019
71 231	Lakeland	M	2	1	6.60, 7.64	.018
71 232	Lakeland	M	2	1	24.48	.030
71 233	Lakeland	M	3	1	18.05	.032
71 234	Lakeland	M	2	1	7.99	.019
71 235	Lakeland	M	2	1	4.69	.015
71 236	Lakeland	M	2	1	8.51, 12.33	.022
71 237	Lakeland	M	2	1	14.93	.028
71 238	Lakeland	M	2	1	5.90	.017
71 239	Lakeland	M	2	1	7.46	.019
71 240	Winter Haven	N	2	1	10.42	.010
71 241	Winter Haven	N	2	1	Lost	----
71 242	Winter Haven	N	2	1	2.08	.006
71 243	Winter Haven	N	2	1	1.74	.006
71 244	Winter Haven	N	2	1	1.56	.006
71 245	Winter Haven	N	2	1	4.17	.007
71 246	Winter Haven	N	2	1	Lost	----
71 247	Winter Haven	N	2	1	Lost	----
71 248	Winter Haven	N	2	1	1.56	.006
71 249	Winter Haven	N	2	1	1.39	.006
71 250	Winter Haven	N	2	1	2.78	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 251	Winter Haven	N	2	1	6.94, 2.95	.007
71 252	Winter Haven	N	2	1	3.99	.007
71 253	Winter Haven	N	2	1	2.08	.006
71 254	Winter Haven	N	2	1	3.30	.006
71 255	Winter Haven	N	2	1	2.08	.006
71 256	Winter Haven	N	2	1	0.87, 1.39	.006
71 257	Winter Haven	N	2	1	Lost	----
71 258	Winter Haven	N	2	1	5.21	.007
71 259	Winter Haven	N	2	1	0.69	.006
71 260	Winter Haven	N	2	1	2.08	.006
71 261	Bartow	N	2	1	5.21, 4.51	.007
71 262	Bartow	N	2	1	Lost	----
71 263	Bartow	N	2	1	4.51	.007
71 264	Bartow	N	2	1	Lost	----
71 265	Bartow	N	2	1	4.51	.007
71 266	Bartow	N	2	1	7.64, 6.42	.008
71 267	Winter Haven	N	2	1	2.43	.006
71 268	Winter Haven	N	2	1	2.95	.006
71 269	Winter Haven	N	2	1	2.60	.006
71 270	Winter Haven	N	2	1	3.99	.007
71 271	Winter Haven	N	2	1	3.65, 3.47	.007
71 272	Winter Haven	N	2	1	2.43	.006
71 273	Winter Haven	N	2	1	1.74	.006
71 274	Winter Haven	N	2	1	4.34	.007
71 275	Winter Haven	N	2	1	3.65	.007

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm²	Mean WL Less Than
71 276	Winter Haven	N	2	1	3.30, 3.30	.006
71 277	Winter Haven	N	2	1	0.17	.006
71 278	Winter Haven	N	2	1	3.30	.006
71 279	Winter Haven	N	2	1	2.95	.006
71 280	Winter Haven	N	2	1	1.74	.006
71 281	Winter Haven	N	2	1	2.43, 2.26	.006
71 282	Winter Haven	N	2	1	2.95	.006
71 283	Winter Haven	N	2	1	1.91	.006
71 284	Winter Haven	N	2	1	1.74	.006
71 285	Winter Haven	N	2	1	3.12	.006
71 286	Winter Haven	N	2	1	Lost	----
71 287	Lakeland	M	2	1	Lost	----
71 288	Lakeland	M	2	1	26.21	.042
71 289	Lakeland	M	2	1	15.28	.028
71 290	Lakeland	M	2	1	9.55	.021
71 291	Lakeland	M	2	1	11.28, 9.20	.022
71 292	Lakeland	M	2	1	10.76	.023
71 293	Lakeland	M	2	1	4.34	.015
71 294	Lakeland	M	2	1	19.96	.034
71 295	Lakeland	M	2	1	33.50	.050
71 296	Lakeland	M	2	1	8.33, 6.60	.019
71 297	Lakeland	M	2	1	5.90	.017
71 298	Lakeland	M	2	1	12.33	.025
71 299	Lakeland	M	2	1	16.84	.030
71 300	Lakeland	M	2	1	17.36	.031

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 301	Tampa	N	2	1	1.56	.006
71 302	Tampa	N	2	1	1.91	.006
71 303	Tampa	N	2	1	1.74	.006
71 304	Tampa	N	2	1	0.35	.006
71 305	Tampa	N	2	1	1.91, 1.74	.006
71 306	Tampa	N	2	1	1.91	.006
71 307	Tampa	N	2	1	0.17	.006
71 308	Tampa	N	2	1	2.60	.006
71 309	Tampa	N	2	1	3.12	.006
71 310	Tampa	N	2	1	1.91	.006
71 311	Tampa	N	2	1	1.74, 0.17	.006
71 312	Tampa	N	2	1	2.60	.006
71 313	Tampa	N	2	1	0.69	.006
71 314	Tampa	N	2	1	3.82	.007
71 315	Tampa	N	2	1	13.89, 15.45	.012
71 316	Tampa	N	2	1	5.38	.007
71 317	Lutz	N	2	1	1.91	.006
71 318	Tampa	N	2	1	0.87	.006
71 319	Tampa	N	2	1	3.30	.006
71 320	Tampa	N	2	1	1.04, 1.04	.006
71 321	Tampa	N	2	1	1.39	.006
71 322	Tampa	N	2	1	0.87	.006
71 323	Tampa	N	2	1	0.17	.006
71 324	Tampa	N	2	1	2.60	.006
71 325	Tampa	N	2	1	0.69, 0.87	.006

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 326	Plant City	M	2	1	1.39	.012
71 327	Plant City	M	2	0	6.42	.018
71 328	Plant City	M	2	0	9.55	.021
71 329	Plant City	M	2	0	4.17	.015
71 330	Plant City	M	2	0	2.78, 2.60	.013
71 331	Plant City	M	2	0	0.35	.012
71 332	Plant City	M	2	0	2.26	.012
71 333	Plant City	M	2	0	3.65	.014
71 334	Lithia	M	2	0	Lost	----
71 335	Lithia	M	2	0	37.84, 35.94	.055
71 336	Lithia	M	2	0	6.25	.017
71 337	Lithia	M	2	0	1.04	.012
71 338	Mulberry	M	2	0	3.47	.014
71 339	Lithia	M	2	0	3.30	.014
71 340	Plant City	M	2	0	0.69, 1.04	.012
71 341	Plant City	M	2	0	2.95	.013
71 342	Plant City	M	2	0	0.52	.012
71 343	Plant City	M	2	0	2.26	.012
71 344	Plant City	M	2	0	5.38	.016
71 345	Lithia	M	2	0	0.17, 1.74	.012
71 346	Dover	M	4	0	2.95	.013
71 347	Brandon	M	4	0	Lost	----
71 348	Dover	M	4	0	1.56	.012
71 349	Dover	M	4	0	2.43	.013
71 350	Dover	M	4	0	2.26, 2.26	.012

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm^2	Mean WL Less Than
71 351	Plant City	R	4	82	Lost	----
71 352	Durant	R	3	32	2.78	.012
71 353	Durant	R	2	32	0.35	.012
71 354	Plant City	R	4	32	7.29	.016
71 355	Plant City	R	3	112	Lost	----
71 356	Valrico	R	2	2	3.12	.014
71 357	Plant City	R	2	50	2.26	.012
71 358	Lithia	R	3	-	7.99	.019
71 359	Lithia	R	3	-	2.95	.013
71 360	Lakeland	M	3	1	12.67	.025
71 361	Lakeland	M	2	1	Lost	----
71 362	Lakeland	M	2	1	14.06	.027
71 363	Auburndale	N	2	1	4.34	.007
71 364	Auburndale	N	2	1	2.78	.006
71 365	Auburndale	N	2	1	3.99	.007
71 366	Auburndale	N	2	1	4.17, 4.17	.007
71 367	Auburndale	N	2	1	6.25	.008
71 368	Auburndale	N	2	1	3.47	.007
71 369	Winter Haven	N	2	1	Lost	----
71 370	Winter Haven	N	2	1	3.30	.006
71 371	Winter Haven	N	2	1	3.12, 3.30	.006
71 372	Winter Haven	N	2	1	5.21	.007
71 373	Winter Haven	N	2	1	4.17	.007
71 374	Winter Haven	N	2	1	2.43	.006
71 375	Auburndale	N	2	1	Lost	----

ATTACHMENT 2

RESULTS OF TRACK ETCH DOSIMETERS

Loc. No.	City	Land Class	Structure Type	Surface Soil	Track Density T/mm2	Mean WL Less Than
71 376	Auburndale	N	2	1	3.82, 5.03	.007
71 377	Auburndale	N	2	1	2.95	.006
71 378	Auburndale	N	2	1	4.17, 3.30	.007
71 379	Auburndale	N	2	1	4.34, 3.30	.007
71 380	Auburndale	N	3	1	1.74, 1.22	.006
71 381	Winter Haven	N	2	1	7.29, 9.37	.009
71 382	Winter Haven	N	2	1	1.22	.006
71 383	Winter Haven	N	2	1	2.60	.006
71 384	Winter Haven	N	2	1	2.08	.006
71 385	Winter Haven	N	2	1	3.13	.006
71 386	Winter Haven	N	2	1	3.47, 5.03	.007
71 387	Winter Haven	N	2	1	4.17	.007
71 388	Winter Haven	N	2	1	4.34	.007
71 389	Winter Haven	N	2	1	4.17	.007
71 390	Winter Haven	N	2	1	2.95	.006
71 391	Winter Haven	N	2	1	2.6, 5.73	.007
71 392	Winter Haven	N	2	1	2.95, 1.91	.006
71 393	Winter Haven	N	2	1	5.21, 3.3	.007
71 394	Fort Meade	M	3	0	Lost	----
71 395	Fort Meade	R	4	16	8.51	.017
71 396	Fort Meade	R	4	16	2.43	.009
71 397	Fort Meade	M	4	0	12.33	.025